Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119

ATTN: Amara Vandervort amarav@windwardenv.com

SUBJECT: Revised Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the revised validation reports for the fractions listed below. Please replace the previously submitted reports with the enclosed revised reports.

LDC Project #48680RV1:

SDG # Fraction

20F0039, 20F0075 20F0094, 20F0157 Semivolatiles, Hexachlorobenzene, Polychlorinated Biphenyls, Metals

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation; May 2020
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review;
 January 2017
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review;
 January 2017
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any guestions.

Sincerely,

Pei Gena

pgeng@lab-data.com

Project Manager/Senior Chemist

August 19, 2020

2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Amara Vandervort amarav@windwardenv.com

August 13, 2020

SUBJECT: Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on July 17, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #48680:

SDG #	<u>Fraction</u>
20F0039, 20F0075, 20F0094	Semivolatiles, Hexachlorobenzene, Polychlorinated
20F0105, 20F0109, 20F0157	Biphenyls, Metals, Wet Chemistry, Polychlorinated
20F0186, 20F0191, 20F0194	Dioxins/Dibenzofurans

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation; May 2020
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review;
 January 2017
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review;
 January 2017
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng

pgeng@lab-data.com

Project Manager/Senior Chemist

Attachment 1 14,171 pages-ADV R1 (Added Stage 4 to PCB for C & I) LDC #48680 (Windward Environmental LLC - Seattle WA / Duwamish AQC4)

St	Stage 2B/4 (client Select) EDD LDC #48680 (Windward Environmental, LLC - Seattle WA / Duwami										ish	AO	C4))																					
LDC	SDG#	DATE REC'D	(3) DATE DUE		OA 70E)	PA (82) -SI	70E	(1 Pe (808	est		Bs 32A)		tals 20A)	H (747		Dio:		TC (906		To Sol (254	lids														
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Α	20F0039	07/17/20	08/07/20	0	1	0	1	0	1	0	2	0	1	0	1	0	1	0	2	0	2											Ш		Ш	Ш
В	20F0075		08/07/20	-	7	0	10	0	7	0	13	0	10	0	7	0	1_	0	11	0	11											\square			Ш
С	20F0094	07/17/20	08/07/20	0	8	0	12	0	8	0	15	0	12	0	8	0	1	0	15	0	15											Ш			Ш
D	20F0105		08/07/20	-	-	-	_	-	-	0	4	0	1	-	-	0	1	0	4	0	4											\sqcup		\square	Ш
E	20F0109	07/17/20	08/07/20	0	3	0	3	0	3	0	10	0	5	0	3	-	_	0	9	0	9											igsqcup			Ш
F	20F0157		08/07/20	-	5	0	4	0	4	0	4	0	4	0	4	0	1	0	4	0	4											Ш		Ш	Ш
G	20F0186		08/07/20	_	3	0	2	0	2	0	6	0	6	0	2	0	4	0	6	0	6											Ш		Ш	Ш
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 18, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0310-SRM1	Phenol Naphthalene Acenaphthylene Anthracene	36.2 (42-150) 22.2 (33-167) 41.7 (52-148) 56.7 (57-143)	All samples in SDG 20F0039	J (all detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	Phenol Naphthalene Acenaphthylene Anthracene	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

SDG Labo	#:_ 20F0039 oratory: <u>Analytical Resources, Inc.</u>	S	tage 2B	WORKSHEET		Date: 08/05/ Page: of / eviewer: W eviewer:
The	HOD: GC/MS Semivolatiles (EPA SW 84) samples listed below were reviewed for eation findings worksheets.		-	tion areas. Validation	n findings are r	oted in attached
Validi				Comme		
<u> </u>	Validation Area	AIA		Comme	enis	
<u> </u> .	Sample receipt/Technical holding times GC/MS Instrument performance check					
111.		AIA	ICAL	= 20%	1005	= 30 }
IV.		A		20%		
V.	Laboratory Blanks	A				
VI.						
VII.		A				
VIII		N				
IX.	Laboratory control samples	SN	V	S SRM		
X.	Field duplicates	N				
XI.	Internal standards	A				
XII.	Compound quantitation RL/LOQ/LODs	N				
XIII	. Target compound identification	N				
XIV	. System performance	N				
XV.	Overall assessment of data	I A				
Note:	N = Not provided/applicable R = Ria	No compounds nsate Field blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Sourc OTHER:	e blank
	Client ID			Lab ID	Matrix	Date
1	LDW20-SC109			20F0039-04	Sediment	06/01/20
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VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

METHODI GOMB CTOX				
A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachiorophenol	U1. Famphur
V. 4-Chioro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48680 A 2a

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> / SRM

Page: __l_of__/
Reviewer: __J\(\subseteq \text{L}\)
2nd Reviewer: ___

METHOD: GC/MS BNA (EPA SW 846 Method 8270@)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Was a LCS required?

Y N N/A

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0310-5R	M1 A	36.2 (42-158)	()	()	All (Det)	J/UJ/P
		\ <u>\</u>	22.2 (33-167)	()	()		
		DD	41.7 (52-148)	()	()		
		y v	56.7 (57-143	()	()	<i>y y</i>	/
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC109	20F0039-04	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date Compound		Associated %D Samples		Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	All samples in SDG 20F0039	UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/16/20	Benzoic acid	29.2	All samples in SDG 20F0039	J (all detects) UJ (all non-detects)	Α
	Pentachlorophenol	40.6		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0310-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	11.7 (34-166) 11.6 (36-164) 26.5 (40-160) 28.6 (38-162)	All samples in SDG 20F0039	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	N-Nitrosodiphenylamine	UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SC109	Benzoic acid Pentachlorophenol	UJ (all non-detects)		Continuing calibration (%D)
LDW20-SC109	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

THOD: GC/MS Polymuelear Arematic Hydroearbons (EPA SW 846 Method 8270E-SIM) ie samples listed below were reviewed for each of the following validation areas. Validation findings are noted lidation findings worksheets. Validation Area)G#	48680A2b VALIDATION CONTROL CO		TENES ge 2B	S WORKSHE		Date: 08/0 Page:of
I. Sample receipt/Technical holding times A / A II. GC/MS instrument performance check A III. Initial calibration/ICV A / SW ICAL = 20 7, YY ICAL = 3/ IV. Continuing calibration SW CCAL = 20 1, V. Laboratory Blanks A VI. Field blanks N VII. Surrogate spikes A VIII. Matrix spike/Matrix spike duplicates N IX. Laboratory control samples SW LCS SRM XI. Internal standards N XII. Internal standards A XIII. Compound quantitation RL/LOQ/LODs N XIVII. Target compound identification N XIV. Overall assessment of data A XIV. Overall assessment of data XIV. Overall assessment of data XIV. See worksheet R = Field blank EB = Equipment blank Ciient ID Lab ID Matrix D Lab ID Matrix D Lab ID Matrix D Lab ID Matrix D LDW20-SC109 20F0039-04 Sediment 0	ETH(S VO A OD: GC/MS Polynuclear Aromatic Hyd mples listed below were reviewed for a				IM)	Reviewer: 100 nd Reviewer: (
II. GC/MS Instrument performance check A		Validation Area			Coi	mments	
III. GC/MS instrument performance check A	l.		AIA				
III. Initial calibration/ICV A / SW ICAL = 20 7, YY IW = 2 IV. Continuing calibration V. Laboratory Blanks VI. Field blanks VII. Surrogate spikes VIII. Matrix spike/Matrix spike duplicates IX. Laboratory control samples XX. Field duplicates XX. Internal standards XXII. Compound quantitation RU/LOQ/LODs XXIII. Target compound identification XXIV. System performance XXV. Overall assessment of data Ate: A = Acceptable SW = See worksheet A = Acceptable SW = See worksheet B = Field blank Client ID Lab ID Matrix D = Duplicate SB=Source blan OTHER: EB = Equipment blank B = Equipment blank Client ID Lab ID Matrix D = Duplicate SB=Source blan OTHER: Client ID Lab ID Matrix D = Client ID Lab ID D = Client ID D = Client ID Lab ID D = Client	н.	GC/MS Instrument performance check	A				
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XI. Internal standards XII. Compound quantitation RL/LOQ/LODs XIII. Target compound identification XIV. System performance XV. Overall assessment of data te: A = Acceptable			Sal		LCS SRM		
XII. Internal standards XII. Compound quantitation RL/LOQ/LODs N XIII. Target compound identification N XIV. System performance N XV. Overall assessment of data te: A = Acceptable N = Not provided/applicable SW = See worksheet N = Field blank Client ID Lab ID Matrix D LDW20-SC109 Applicate SB=Source blant OTHER: Client ID Lab ID Matrix D Lab ID Matrix D Lab ID Matrix D Lab ID Lab ID Matrix D Lab ID Lab ID Matrix D Lab ID			L				
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LDW20-SC109 20F0039-04 Sediment 0		A = Acceptable ND = N = Not provided/applicable R = F	Rinsate	tected	TB = Trip blank	OTH	
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VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphṭhalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ, Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

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VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of
Reviewer:	J YG
2nd Reviewer:	U

SVVA E METHOD: GC/MS PAH (EPA SW 846 Method 8270Ø-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y(N)N/A Were all %D within the validation criteria of ≤20/30% %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><20.0%//30%)</u>	Associated Samples	Qualifications
	02/28/20	SI C0029-SCV1	QQ	34.4	All (ND)	J/UJ/A
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LDC #: 48 680 426

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page:_	l of
Reviewer:	JŲG
2nd Reviewer:	7

SV77 METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A

Was a continuing calibration standard analyzed at least once every 12 hours for each

YN N/A

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

YN N/A

Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/16/20	NT10200616 03	s PPP	29,2		A1) (ND + Det)	J/UJ/A
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LDC #: 486 80 A 26

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS) / SRM

SVA METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was a LCS required?

Y/N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#_	LCS/LCSD ID	Compound	%R	LCS (Limits)	LCSD %R (Limits)		RPD (Limits)		Associated Samples	Qualifications
	BIF 0310- SRMZ	E	11.7	(34-166)	()		()	All (ND + Det)	J/WJ/P
		F	11.6	(36-164)	()		()		
		0	26.5	(40-160)	()		()		
		R	28.6	(38-162)	()		()		/
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0039	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Hexachlorobenzene	165 (26-120)	165 (26-120)	NA	-

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to no ICV performed, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	Hexachlorobenzene	UJ (all non-detects)	А	Initial calibration verification (%D)

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

SDG # Labora	: 48680A3a VALIDATION b: 20F0039 VALIDATION ctory: Analytical Resources, Inc. OD: GC Hexachlorobenzene (EPA SW	Sta	ge 2B	S WORKSHEET		Date: 08/64 Page:of_ eviewer:
The sa	amples listed below were reviewed for e ion findings worksheets.		•	ation areas. Validatio	on findings are r	oted in attache
	Validation Area			Comm	ents	
1.	Sample receipt/Technical holding times	AIA				
II.	GC Instrument Performance Check	N'				
III.	Initial calibration/ICV	A', SW	19	41 5 20 B £ 20 6	IW	¿ Zo?.
IV.	Continuing calibration	A	COVS	£ 20 %		
V.	Laboratory Blanks					
VI.	Field blanks					
VII.	Surrogate spikes / 15	A/A				
VIII.	Matrix spike/Matrix spike duplicates	SM				
IX.	Laboratory control samples	A		us		
X.	Field duplicates	1				
XI.	Compound quantitation/RL/LOQ/LODs	N				
XII.	Target compound identification	N				
XIII.	System Performance	N				
ΧIV	Overall assessment of data	A				
Note:	N = Not provided/applicable R = R	No compounds de linsate Field blank	tected	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sourc OTHER: k	e blank
-	Client ID			Lab ID	Matrix	Date
	_DW20-SC109			20F0039-04	Sediment	06/01/20
	_DW20-SC109MS		******	20F0039-04MS	Sediment	06/01/20
	_DW20-SC109MSD	<u> </u>		20F0039-04MSD	Sediment	06/01/20
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VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychior	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	W
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:	

LDC #: 48680A3a

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:	1_of_1_	
Reviewer:	JVG	
2nd Reviewer:	4	
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METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Y N WAY Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A
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VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:	of \
Reviewer:	1 \ A€
2nd Reviewer:	X

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

<u>YN N/A</u> Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

N N/A Was a MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	2/3	FF	165 (26-120)	()	()	(dy) 1	J dets/A
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC113	20F0039-05	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0039	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Aroclor-1260	-	198 (58-120)	J (all detects)	Α

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Aroclor-1260	40.5 (≤30)	J (all detects)	Α

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and MS/MSD %R and RPD, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109 LDW20-SC113	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SC109	Aroclor-1260	J (all detects)	Α	Matrix spike/Matrix spike duplicate (%R)(RPD)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

	atory: Analytical Resources, Inc.		tage 2B		R 2nd R	Date: 08/0 Page: 1 of 1 Reviewer: 100 Reviewer: 100
	OD: GC Polychlorinated Biphenyls (EPA	SW846 M	ethod 8082A)		ZIIGIN	eviewei.
	amples listed below were reviewed for ea ion findings worksheets.	ach of the fo	llowing valida	tion areas. Validation	on findings are ı	noted in attach
	Validation Area			Comn	nents	
ī.	Sample receipt/Technical holding times	AIA				
11.	Initial calibration/ICV	A/SW	ICAL	= 20% 202	100€	. 20 ß
III.	Continuing calibration	A	CORE	202		
IV.	Laboratory Blanks	Á				
V.	Field blanks	, N				
VI.	Surrogate spikes / 15	A/A				
VII.	Matrix spike/Matrix spike duplicates	SW				
VIII.	Laboratory control samples	A	LCS	SRM		
IX.	Field duplicates	N				
X.	Compound quantitation/RL/LOQ/LODs	N				
XI.	Target compound identification	N				
XII	Overall assessment of data	A				
te:	N = Not provided/applicable R = Rir	lo compounds nsate ield blank	detected	D = Duplicate TB = Trip blank EB = Equipment blar	SB=Source OTHER:	ce blank
	Client ID			Lab ID	Matrix	Date
L	DW20-SC109			20F0039-04	Sediment	06/01/20
	_DW20-SC113			20F0039-05	Sediment	06/01/20
[_DW20-SC109MS			20F0039-04MS	Sediment	06/01/20
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BIFOZ84-BUKL

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	xx.

Notes:	 	

LDC #: 48680 A 3b

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: 1_of 1 Reviewer: JVG 2nd Reviewer: ____

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". What type of initial calibration verification calculation was performed? __%D or ___%R

YN N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

N)N/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIFO176-SCV1	2C	BB	21.0	All (ND+Det)	J/UJ/A
					, <u>, , , , , , , , , , , , , , , , , , </u>		J/UJ/A (zuel Z. AA, BB)
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LDC #:_ 48680A3b

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

	Page:_	\mathcal{L}^{c}	of1
	Reviewer:_	从	⟨G_
2nd	Reviewer:	4	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SD

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Was a MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	3/4	BB	()	198 (58-120)	()	1 (Pet)	Jaks/A
	•	BB BB	()	()	40.5 (30)	1 7	- Y/
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

Although the low level check standard exceeded QC limits for arsenic, no data was qualified since all associated results were greater than 2X the reporting limit.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (All samples in SDG 20F0039)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	А

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (All samples in SDG 20F0039)	Соррег	130 (75-125)	-	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0039

Sample	Analyte	Flag	A or P	Reason
LDW20-SC109	Silver Copper	J (all detects) J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680A4a

SDG #: 20F0039

Stage 2B

Page: 1 of 1 Reviewer: ATL 2nd Reviewer:_

Date: 7/30/20

Laboratory: Analytical Resources, Inc.

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	Α	
101.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	Α	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	(2,3)
VIII.	Duplicate sample analysis	Α	4
IX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
3	LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
4	LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20
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13				

Notes:	 	 	 		 	
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LDC #: 48680A4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
	1 Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
QC	
2,3,4	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
	Analysis Method
ICP	
ICP-MS	
CVAA	

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MC %P	MSD %R	%P Limit	RPD	PDD Limit	Associated Samples	Qualification	Det/ND
2 & 3	S	Analyte	41.5		75-125	KPD	KPD LIIIIL	all	J/UJ/A	Det
2 03	 	Cu			75-125 75-125		 	all		
		Cu	130		/3-125			all	Jdet/A	Det
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Comments:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC113	20F0039-05	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0039

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A6 VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0039

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 7/30/20
Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

vandat	ion indings worksneets.		
	Validation Area		Comments
1.	Sample receipt/Technical holding times	A/A	
- 11	Initial calibration	А	
111.	Calibration verification	А	
IV	Laboratory Blanks	sw	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	А	3
VII.	Duplicate sample analysis	А	4
VIII.	Laboratory control samples	А	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	А	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	OliA ID	Lat ID		Τ.
<u> </u>	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC113	20F0039-05	Sediment	06/01/20
3	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
4	LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20
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Notes:	 		
		V	

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1,2	TS, TOC	
QC		
4	TS, TOC	
3	TOC	

LDC #: 48680A6

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: all

Analyte		INKKKK						Samp	ole Identific	ation		
	PB (units)		Action Level									
тос		0.02										

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0039	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0039

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC109DUP (LDW20-SC109)	OCDF	46.2 (≤25)	J (all detects)	Α

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag_	A or P
All samples in SDG 20F0039	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration, DUP RPD, and compounds reported as EMPC, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-SC109	OCDF	J (all detects)	Α	Duplicate sample analysis (RPD)
LDW20-SC109	DW20-SC109 All compounds reported as estimated maximum possible concentration (EMPC).		А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

SDG # _abora	t: 48680A21 VALIDATIO #: 20F0039 atory: Analytical Resources, Inc. IOD: HRGC/HRMS Polychlorinated Dioxi	S	Stage 2B	WORKSHEE Method 1613B)	R	Date: 08/07/20 Page: 1_of 1 eviewer: JVG eviewer:	
	amples listed below were reviewed for ea tion findings worksheets.	ch of the fo	ollowing valida	tion areas. Validat	ion findings are r	noted in attached	
	Validation Area			Comi	ments		
l.	Sample receipt/Technical holding times	A/A					
II.	HRGC/HRMS Instrument performance check	A					
111.	Initial calibration/ICV	A/A	ICAL ≤	20/35%	CV ≤ QC Limits		
IV.	Continuing calibration	sw	CCV ≤	QC Limits			
V.	Laboratory Blanks	sw					
VI.	Field blanks	N					
VII.	Matrix spike/Matrix spike duplicates/LD	N/SW					
VIII.	Laboratory control samples	Α	OPR,	SRM			
IX.	Field duplicates	N			<u>-</u>		
Χ.	Labeled Compounds	Α					
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC	EMPC = Jdets/A			
XII.	Target compound identification	N					
XIII.	System performance	N					
XIV.	Overall assessment of data	A					
lote:	N = Not provided/applicable R = Rin	o compounds sate eld blank	s detected	D = Duplicate TB = Trip blank EB = Equipment bla	SB=Sourc OTHER: ank	ce blank	
	Client ID			Lab ID	Matrix	Date	
1 1	LDW20-SC109			20F0039-04	Sediment	06/01/20	
2 1	LDW20-SC109DUP			20F0039-04DUP	Sediment	06/01/20	
3							
4							
5							
6							
7							
8							
9							
10							
lotes:							

BIF0465-BLK1

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:			

LDC #: 48680A21_

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page: 1 of 1 Reviewer: _ 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- <u>Y</u> <u>N</u> <u>Y</u> Was a routine calibration performed at the beginning of each 12 hour period?
- Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
					<u> </u>		
<u> </u>							
				<u> </u>			
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		<u> </u>					
		_					

LDC #: 48680A21

VALIDATION FINDINGS WORKSHEET Blanks

F	⊃age _	<u>1</u> 0	f_1_
Revi	ewer:_	JV	<u>'G</u>
2nd Revi	ewer:_	\mathcal{L}	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- $\frac{Y}{Y}$ Were all samples associated with a method blank?
- Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Was the method blank contaminated?

Blank extraction date:____06/22/20 Blank analysis date: 06/25/20 Associated samples: All (>5x) Conc. units: na/Ka

Tonor unito ing/										
Compound	Blank ID					S	<u>ample Identi</u>	<u>fication</u>		
	BIF0465-BLK1	(5x)								
В	0.175	0.88								
М	0.0946*	0.47								
О	0.166	0.83								
Q	0.521*	2.61								
G	1.32	6.60								
S	0.175	0.88								
Υ	0.166	0.83						l	<u> </u>	

*EMPC

LDC #: 48680A21

VALIDATION FINDINGS WORKSHEET <u>Duplicate Analysis</u>

Pag	je: <u>_</u> 1	<u>_</u> o	f_1_	
Reviewe	er:	Д	/G	_
2nd Reviewe	er:_			

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Was a duplicate sample analyzed for each matrix in this SDG?

N Were all duplicate sample relative percent differences (RPD) < 25?

#	Duplicate ID	Compound	RPD (Limits)		Associated Samples	Qualifications
	2	Q	46.2 (≤25	5%)	1 (Det)	Jdets/A
			(≤)		
			(≤)		
			(≤)		
			(≤)		
			(≤)		
			(≤)		
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Comments:	 	 		
			-	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 11.6°C, and 12.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0380-SRM1	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene Benzo(a)pyrene	40.0 (42-158) 16.2 (33-167) 32.4 (52-148) 46.9 (51-149) 44.6 (57-143) 53.8 (54-146)	All samples in SDG 20F0075	J (all detects)	P

X. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC123	LDW20-SC123FD	RPD
Phenol	14.1	18.6	28
Naphthalene	11.0	12.3	11
2-Methylnaphthalene	13.1	11.9	10
Acenaphthylene	7.6	6.8	11
Dimethylphthalate	7.4	19.3U	Not calculable
Acenaphthene	6.6	5.4	20

	Concentration (ug/Kg)		
Compound	LDW20-SC123	LDW20-SC123FD	RPD
Dibenzofuran	9.3	7.8	18
Fluorene	7.8	7.2	8
Phenanthrene	57.5	48.6	17
Anthracene	18.5	15.6	17
Fluoranthene	115	105	9
Pyrene	142	136	4
Butylbenzylphthalate	74.7	22.6	107
Benzo(a)anthracene	56.5	48.1	16
Chrysene	80.5	67.1	18
Bis(2-ethylhexyl)phthalate	141	124	13
Benzofluoranthenes, total	183	159	14
Benzo(a)pyrene	71.0	61.6	14
Indeno(1,2,3-cd)pyrene	46.6	42.2	10
Dibenzo(a,h)anthracene	12.7	11.8	7
Benzo(g,h,i)perylene	56.2	49.2	13

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in seven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene Benzo(a)pyrene	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #:_	48680B2a	VALIDATION COMPLETENESS WORKSHEET
SDG #:	20F0075	Stage 4

Date:	08/05/20
Page:_	1 of 1
Reviewer:	Ne
2nd Reviewer:	C

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1	Sample receipt/Technical holding times	SWIA	Cooler temps = 9.6°C 12.8°C 11.6°C (Insufficient
11.	GC/MS Instrument performance check	I'A'	(11.0
≡.	Initial calibration/ICV	AA	1915 20 % 1015 30% CWE 20%
IV.	Continuing calibration	A	CW & 70 G
V.	Laboratory Blanks	A	
VI.	Field blanks	l N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS SRM
X.	Field duplicates	SW	LCS SRM $D = 4/5$
XI.	Internal standards	A	,
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC102	20F0075-02	Sediment	06/02/20
2	LDW20-SC101	20F0075-03	Sediment	06/02/20
3	LDW20-SC117	20F0075-04	Sediment	06/02/20
4	LDW20-SC123	20F0075-06	Sediment	06/02/20
5	LDW20-SC123FD D	20F0075-07	Sediment	06/02/20
6	LDW20-SC125	20F0075-08	Sediment	06/02/20
7	LDW20-SC130	20F0075-10	Sediment	06/02/20
8	LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
9	LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20
10				
11				
12				
13_	BIF0380-BK1			
14_			<u> </u>	

LDC #: 48680 BZa

VALIDATION FINDINGS CHECKLIST

Page: 1_of 2 Reviewer: __JVG 2nd Reviewer: ___

E

Method: Semivolatiles (EPA SW 846 Method 8270p)

Validation Area	Yes	No	NA	Findings/Comments		
I. Technical holding times						
Were all technical holding times met?						
Was cooler temperature criteria met?						
II. GC/MS Instrument performance check						
Were the DFTPP performance results reviewed and found to be within the specified criteria?						
Were all samples analyzed within the 12 hour clock criteria?						
Illa. Initial calibration						
Did the laboratory perform a 5 point calibration prior to sample analysis?						
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) within method criteria?						
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of \geq 0.990?			/			
IIIb. Initial Calibration Verification						
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?						
Were all percent differences (%D) ≤ 30%?						
IV. Continuing calibration						
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?						
Were all percent differences (%D) \leq 20% and relative response factors (RRF) within method criteria?						
V. Laboratory Blanks						
Was a laboratory blank associated with every sample in this SDG?						
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?						
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.						
VI. Field blanks						
Were field blanks were identified in this SDG?	-					
Were target compounds detected in the field blanks?			_			
VII. Surrogate spikes						
Were all surrogate percent recovery (%R) within QC limits?						
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?						
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R?						
VIII. Matrix spike/Matrix spike duplicates						
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	/					

LDC #: 48680 B2a

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: JVG
2nd Reviewer: _____

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?				
Were retention times within ± 30 seconds of the associated calibration standard?				
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				
XIII. Target compound identification			•	
Were relative retention times (RRT's) within <u>+</u> 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				
Were chromatogram peaks verified and accounted for?				
XIV. System performance				
System performance was found to be acceptable.				
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzofluoranthenes, total

LDC#: 48680 \$2a

Y) N N/A

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> / SRM

Page:	of
Reviewer:	JVG
2nd Reviewer:	4

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)		LCSD %R (Limits)	RPD (Limits)		Associated Samples	Qualifications
	BIF0380-SRM1	A	fo.0 (42-	158)	()	()	All (bet)	J/UJ/P
		Ś	16.2 (33-	(4T)	()	()		
		DD	32,4 (52	148)	()	()		
		GG	46,9 (51-1	49)	(')	()		
		√ √	44.6 (57-	43)	()	()		
		III	53.8 (54_	146)	()	()		
			()	()	()		1
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LDC#: 48680B2a

KKK

LLL

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer: VG
2nd Reviewer:

7

13

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

Concentration (ug/Kg) **RPD** Compound 5 4 14.1 18.6 28 s 11.0 12.3 11 W 13.1 11.9 10 DD 7.6 6.8 11 СС 7.4 19.3U NC GG 6.6 5.4 20 JJ 9.3 7.8 18 NN 7.8 7.2 8 UU 57.5 48.6 17 W 18.5 15.6 17 ΥY 115 105 9 ΖZ 142 136 4 74.7 22.6 107 AAA 16 ccc 56.5 48.1 DDD 80.5 67.1 18 EEE 141 124 13 A2 183 159 14 Ш 71.0 61.6 14 JJJ 46.6 42.2 10

11.8

49.2

12.7

56.2

LDC #: 48680B2a

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: 1_of_1 Reviewer: JVG 2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compoun	d (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	02/28/20	Phenol	(DCB)	1.59347	1.59347	1.65585	1.65585	7.959	7.959
			Naphthalene	(NPT)	0.92453	0.92453	0.92758	0.92758	1.339	1.339
	NT10		Diethylphthalate	(ANT)	1.37384	1.37384	1.35321	1.35321	7.313	7.313
			Phenanthrene	(PHN)	1.03992	1.03992	1.02052	1.02052	1.897	1.897
			Chrysene	(CRY)	1.20105	1.20105	1.21232	1.21232	3.091	3.091
			BEHP	(DNOP)	0.49495	0.49495	0.48711	0.48710	3.070	3,070
			Benzo(g,h,i)peryle	ne (PRY)	1.23732	1.23732	1.24193	1.24193	6.014	6.014

LDC # 48680B2a

VALIDATION FINDINGS WORSHEET Continuing Calibration Calculation Verification

Page: 1 of 1 Reviewer: __JVG 2nd Reviewer:_

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

Where:

RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF

Cx = Concentration of compound,

RRF = continuing calibration RRF

Ais = Area of associated internal standard

Ax = Area of compound,

Cis = Concentration of internal standard

ш	Chandard ID	Calibration	C	4 (10)	Average RRF	Reported RRF	Recalculated RRF	Reported % D	Recalculated %D
#	Standard ID	Date	Compoun	d (IS)	(Initial)	(CCV)	(CCV)		
1	NT1020062302.	6/23/2020	Phenol	(DCB)	1.65585	1.62455	1.62455	1.9	1.9
			Naphthalene	(NPT)	0.92758	0.94636	0.94636	2.0	2.0
	NT10		Fluorene	(ANT)	1.55760	1.32268	1.32268	15.1	15.1
			Phenanthrene	(PHN)	1.02052	1.01094	1.01094	0.9	0.9
			Chrysene	(CRY)	1.21232	1.15605	1.15605	4.6	4.6
			BEHP	(DNOP)	0.48711	0.47106	0.47106	3.3	3.3
			Benzo(g,h,i)peryle	ene (PRY)	1.24193	1.17446	1.17446	5.4	5.4

LDC #:_ 48680 B2A

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:	<u>1_of_1_</u>
Reviewer:_	JVG _\
2nd reviewer:_	75

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

5.00

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found SS = Surrogate Spiked

Sample ID:____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	5.00	3.040	60.8	60.8	0
2-Fluorobiphenyl	1	3.626	72.5	72.5	
Terphenyl-d14	<i>y</i>	4.536 3.372	67.4	67.4	
Phenol-d5	7.50	3,953 4,536	60,5	60.5	
2-Fluorophenol		3.953	52.7	\$2.7	
2,4,6-Tribromophenol		5.666	75.6	75,6	
2-Chlorophenol-d4		5.019	66,9	66.9	

3, 229

Sample ID:_____

1,2-Dichlorobenzene-d4

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl			·		
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 48680 B 22

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

	Page:_	1	_of_	1_
	Reviewer:_	J	V <u>.</u> G	
2nd	Reviewer:	_(1	

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration

SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

SA = Spike added

MSDC = Matrix spike duplicate concentration

MS/MSD samples: ___

Compound	Ad	Spike Sample Spiked Sam Added Concentration Concentrat (ひんん) (ひんん (しょん)		ntration	Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD		
	MS	MSD		MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	504	504	92.5	424	448	66.1	66.2	70,4	70,5	4,94	5.03
N- Nitroso-di-n-propylamin e											
4-Chloro-3-methylphenol			7,	412	4.1	80,3	<i>(a)</i>	80,6	6	0 4	- 41-
Acenaphthene			7,1	412	414	80,7	80.3	80,6	80.7	0,459	6.48
Pentachlerephenol					-	C.P.					• -
Pyrene		<u> </u>	216	659	667	87.8	87.9	89.4	89.5	1.26	1,21

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within
0.0% of the recalculated results.

LDC#: 48680BZa

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration

SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCS/LCSD samples:

BI F0380- PS1

Compound	A	pike dded () (kg.)	Spike Concentration (以 /kg)			I CS Percent Recovery		L CSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated	
Phenol	510	M	397	MA	79.3	79.3					
N-Nitroso-di-n-propylamine										-	
4-Chlere-3-methylphenel											
Acenaphthene			350		69.9	69-9					
P entachlorophen ol					•						
Pyrene	<i>\</i>		400	1	80.0	80,0					
										·	
							4				

Comments:	Refer to Laboratory	Control Sample/Laboratory	Control Sample	Duplicates findings	worksheet for list	of qualifications and a	associated samples when
reported resi	ults do not agree witl	hin 10.0% of the recalculated	l results.				
		The state of the s		**************************************			

LDC #: 48\$80 \$20

Df

%S

2.0

Dilution Factor.

Percent solids, applicable to soil and solid matrices

Factor of 2 to account for GPC cleanup

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_1_	of	1_
Reviewer:	JV	}
2nd reviewer:	<u>S</u>	

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

	N/A N/A	Were all reported results recalculated and Were all recalculated results for detected t	verified for all level IV samples? arget compounds agree within 10.0% of the reported results?
Conce	entratio	$n = (A_{s})(I_{s})(V_{t})(DF)(2.0)$ $(A_{ls})(RRF)(V_{o})(V_{i})(%S)$	Example:
A_{x}	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D. Chrysene
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard	
l _s	=	Amount of internal standard added in nanograms (ng)	Conc. = $\frac{(1075(4)(4,0)(101)(600)(101)}{(368779)(1.21232)(16.65g)(0.5880)(101)}$
V_{\circ}	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	· ·
V_{l}	=	Volume of extract injected in microliters (ul)	= 115.4 ug /kg
V_{t}	=	Volume of the concentrated extract in microliters (ul)	U

#	Sample ID	Compound	Reported Concentration (いんたみ	Calculated Concentration ()	Qualification
	1	Chrysene	115	115	_
		1			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT127MS	20F0075-11MS	Sediment	06/02/20
LDW20-IT127MSD	20F0075-11MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	J (all detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/23/20	Benzoic acid	29.2	LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0656-BLK2	06/23/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	0.7 ug/Kg 0.8 ug/Kg	All samples in SDG 20F0075

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SC102	1,4-Dichlorobenzene 1,2-Dichlorobenzene	3.0 ug/Kg 1.3 ug/Kg	3.0U ug/Kg 1.3U ug/Kg
LDW20-SC101	1,4-Dichlorobenzene	3.6 ug/Kg	3.6U ug/Kg
LDW20-SC117	1,4-Dichlorobenzene	1.8 ug/Kg	1.8U ug/Kg
LDW20-SC123	1,4-Dichlorobenzene	2.1 ug/Kg	2.1U ug/Kg
LDW20-SC123FD	1,2-Dichlorobenzene	1.2 ug/Kg	1.2U ug/Kg
LDW20-SC125	1,4-Dichlorobenzene	1.5 ug/Kg	1.5U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT127MS/MSD (LDW20-IT127)	Chrysene	126 (48-120)		J (all detects)	Α

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC123	LDW20-SC123FD	RPD
1,4-Dichlorobenzene	2.1	27.3	171
1,2-Dichlorobenzene	4.9U	1.2	Not calculable
Benzyl alcohol	13.2	17.5	28
Benzoic acid	38.5	54.3	34
N-Nitrosodiphenylamine	3.1	2.9	7

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and MS/MSD %R, data were qualified as estimated in eight samples.

Due to laboratory blank contamination, data were qualified as not detected in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Benzoic acid	J (all detects)	Α	Continuing calibration (%D)
LDW20-IT127	Chrysene	J (all detects)	Α	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0075

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC102	1,4-Dichlorobenzene 1,2-Dichlorobenzene	3.0U ug/Kg 1.3U ug/Kg	А
LDW20-SC101	1,4-Dichlorobenzene	3.6U ug/Kg	Α
LDW20-SC117	1,4-Dichlorobenzene	1.8U ug/Kg	Α
LDW20-SC123	1,4-Dichlorobenzene	2.1U ug/Kg	Α
LDW20-SC123FD	1,2-Dichlorobenzene	1.2U ug/Kg	Α
LDW20-SC125	1,4-Dichlorobenzene	1.5U ug/Kg	А

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B2b

VALIDATION COMPLETENESS WORKSHEET

Stage 4

SDG #: 20F0075

Laboratory: Analytical Resources, Inc.

SVOA

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

Reviewer: 2nd Reviewer:

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	SWIA	Cooler temps = 9.6°C, 12.8°C, 11.6°C (Insufficient)
11.	GC/MS Instrument performance check	L'A	
III.	Initial calibration/ICV	A / SW	IGAL & 20% MY LOVE
IV.	Continuing calibration	SM	CM = 203
V.	Laboratory Blanks	SVA	
VI.	Field blanks	2	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	ŚW	
IX.	Laboratory control samples	A	LCS SRM
X	Field duplicates	SW	D = 5/s
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	Ä	
XV.	Overall assessment of data	À	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

i ==				
<u></u>	Client ID	Lab ID	Matrix	Date
1 2	LDW20-IT106	20F0075-01	Sediment	06/02/20
2 1	LDW20-SC102	20F0075-02	Sediment	06/02/20
3 1	LDW20-SC101	20F0075-03	Sediment	06/02/20
4 1	LDW20-SC117	20F0075-04	Sediment	06/02/20
₅ 1	LDW20-SC123	20F0075-06	Sediment	06/02/20
6	LDW20-SC123FD	20F0075-07	Sediment	06/02/20
7 1	LDW20-SC125	20F0075-08	Sediment	06/02/20
8 2	LDW20-IT105	20F0075-09	Sediment	06/02/20
9 \	LDW20-SC130	20F0075-10	Sediment	06/02/20
10 2	LDW20-IT127	20F0075-11	Sediment	06/02/20
11_	LDW20-IT127MS	20F0075-11MS	Sediment	06/02/20
12	LDW20-IT127MSD	20F0075-11MSD	Sediment	06/02/20
13				
14 1	BIF0380-Bik2			

7 BI F0329-BIKL

CPAH = 1,8,10

48680 B26 LDC #:_

VALIDATION FINDINGS CHECKLIST

	Page:_	1 (of_	2	
	Reviewer:_	J	VO	<u> </u>	
2nd	Reviewer:				_
					_

Method: PAH (EPA SW 846 Method 8270/D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			A
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?				1-6
Were all samples analyzed within the 12 hour clock criteria?				
Illa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) \leq 20% and relative response factors (RRF) \geq 0.05?)
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?				
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?				
Were all percent differences (%D) ≤30%?				
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?				
Were all percent differences (%D) \leq 20% and relative response factors (RRF) \geq 0.05?				
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed for each matrix and concentration?				
Was there contamination in the laboratory blanks?				
VI. Field blanks				
Were field blanks identified in this SDG?				
Were target compounds detected in the field blanks?			\triangle	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?				
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?				
f any percent recoveries (%R) was less than 10 percent, was a reanalysis performed o confirm %R?				
VIII. Matrix spike/Matrix spike duplicates				
Nere matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	1			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) vithin the QC limits?			/	

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: JX/G
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				*
X. Field duplicates	اروسسس			
Were field duplicate pairs identified in this SDG?				·
Were target compounds detected in the field duplicates?		,		
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?		·		
Were retention times within ± 30 seconds of the associated calibration standard?				
XII. Compound quantitation	_			
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				
XIII. Target compound identification				
Were relative retention times (RRT's) within <u>+</u> 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				
Were chromatogram peaks verified and accounted for?		l		
XIV. System performance				
System performance was found to be acceptable.		-		
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. Ť,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
i. 4-Methylphenoi	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

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VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u> </u>
Reviewer:_	ŢVG
2nd Reviewer:_	4

METHOD: GC/MS PAH (EPA SW 846 Method 8270P-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A

Was an initial calibration verification standard analyzed after each ICAL for each instrument? N N/A Y(N)N/A Were all %D within the validation criteria of ≤20/30% %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.9%(30%) 34. 4	Associated Samples	Qualifications
	02/28/20	SICODZ9-SCV1	RR	34.4	2-7,9 MB1 (Det)	Qualifications J / UJ / A
					·	

48 660 B26 LDC #:

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:	<u>\</u> 0	of	
Reviewer:	J.	(G	
2nd Reviewer:	\Box		

METHOD: GC/MS PAH (EPA SW 846 Method 8270) SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Were percent differences (%D) < 20 % and relative response factors (RRE) within the method criteria.

- 1		Į.		Finding %D	Finding DDE		
#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/23/20	NT 10200623035	PPP	29,2			4) I/UJ/A
						,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	3/010 / A
ı							
	 						
							· · · · · · · · · · · · · · · · · · ·
							
						·	
							
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					·		
		-					

LDC	#:	486	80	1326

VALIDATION FINDINGS WORKSHEET Blanks

Page:_	of
Reviewer:	JVG
2nd Reviewer:_	4

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(N) N N/A Was a method blank analyzed for each matrix?

Y/N N/A Was a method blank analyzed for each concentration preparation level?

Y N N/A Was a method blank associated with every sample?

Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 06/23/20 Blank analysis date: 06/23/20

Conc. units: 49 /k Associated Samples: 2-7 9

Compound	Blank ID								
	BIF 0380_	BUL 2	2	3	4	5	4	7	
E	0.7		3.6/U	3.6/u	1.8/U	2.1/y		1.5/4	
F	0.8		1.3/				1.2/4		

Blank extraction date:	Blank analysis date:
Conc. units:	Associated Samples:

Compound	Blank ID					
					·	
						•

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #:	186	80	B	26
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VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:_	<u> </u>	1
Reviewer:	JVG	
2nd Reviewer:_	4	

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD.

Soil / Water.

Was a MS/MSD analyzed every 20 samples of each matrix?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		11/12	PDD	126 (48-120)	()	()	lo (Pet)	Jah /A
		,		()	()	()		
				()	()	()		
				()	()	()		
				()	()	()		
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LDC#: 48680B2b

AN NA

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)
N NA
Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	5	6	RPD
Е	2.1	27.3	171
F	4.9U	1.2	NC
QQQ	13.2	17.5	28
PPP	38.5	54.3	34
QQ	3.1	2.9	7

V:\Josephine\FIELD DUPLICATES\48680B2a windward duwamish.wpd

LDC #: 48680B2b

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:_	<u>1_of_1</u>
Reviewer:	JVG
2nd Reviewer: _	0

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs.

X = Mean of the RRFs

					Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
H	}	Calibration			RRF	RRF	Average RRF	Average RRF	%RSD	%RSD
#	Standard ID	Date	Compound	(IS)	(RRF 5 std)	(RRF 5 std)	(Initial)	(Initial)	L	
1	ICAL	02/28/20	1,4-DCB	(DCB)	1.31443	1.31443	1.41049	1.41049	10.3	10.3
	SIM		1,2,4-TCB	(NPT)	0.36297	0.36297	0.40284	0.40284	12.2	12.2
1	NT10		Pentachlorophenol	(PHN)	0.19257	0.19257	0.16863	0.16863	11.6	11.6
	11									

					Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
		Calibration			RRF	RRF	Average RRF	Average RRF	%RSD	%RSD
#	Standard ID	Date	Compoun	d (IS)	(RRF 2.5 std)	(RRF 2.5 std)	(Initial)	(Initial)		
2	ICAL	05/11/20	Chrysene	(CRY)	1.22429	1.22429	1.17941	1.17941	5.1	5.1
li l	SIM		Benzo(a)pyrene	(PRY)	1.17321	1.17321	1.08195	1.08195	9.9	9.9
	NT8									

LDC # 48680B2a

VALIDATION FINDINGS WORSHEET Continuing Calibration Calculation Verification

Page:_	<u>1</u> of <u>1</u>
Reviewer: _	JVG
2nd Reviewer:	T
'	

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-)S/M)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

Where:

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

Ax = Area of compound,

Cx = Concentration of compound,

Ais = Area of associated internal standard

Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062303S	6/23/2020	1,4-DCB	(DCB)	1.41049	1.35447	1.35447	4.0	4.0
			1,2,4-TCB	(NPT)	0.40284	0.41332	0.41332	2.6	2.6
	NT10		Pentachlorophenol	(PHN)	0.16863	0.17243	0.17243	2.3	2.3
2	N820061502	6/15/2020	Chrysene	(CRY)	1.17941	1.11921	1.11921	5.1	5.1
ŕ	NT8		Benzo(a)pyrene	(PRY)	1.08195	1.02197	1.02197	5.6	5.5

LDC #: 48680 B 26

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:_	1_of_1_	_
Reviewer:_	JVG	
2nd reviewer:		•

Svos

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID:

		Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	W-dio	3,00	1.997	66.6	66.6	0
2-Fluorobiphenyl	KKK-d14	1	2.767	92.7	92.2	· ·
Terphenyl-d14	74-d10		2,485	82-8	82-8	ł

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl				_	
Terphenyl-d14					

Sample ID:

·	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5			·		
2-Fluorobiphenyl					
Terphenyl-d14					

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VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

	Page:_	1	of	1
	Reviewer:		JΛC	3
2nd	Reviewer:		\Box	_

Svog METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: _____

Compound	Ad	ike ded /kg/	Sample Concentration	Spiked Sample Concentration ()		Matrix Percent F		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
reserved and	MS	MSD		MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Acenaphthene						·					
Benzo (a) pyrene	300	300	31-\	380	606	116	116	192	152	45.8	45. 8

Comments: Refer to Matrix Spike/Matrix Spike Duplica	tes findings worksheet for list of qualifications and associated	samples when reported results do not agree within
10.0% of the recalculated results.		·

LDC #: 48680 B 26

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1_of_1_

Reviewer:

2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration

SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCS/LCSD samples: BIF 6780-

	Sı	oike	Sp	ike	10	CS	10	SD ·	I CS	LCSD
Compound	Ad	ded /ka)	Concer	ntration		Recovery	Percent Recovery		RPD	
	LCS	LCSD	cs	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene										
Pyrene										·
PCP	1500	NA	823	VA	54.9	54.9				
									y).	

Comments:	Refer to Laboratory	Control Sample/Laboratory	Control Sample	Duplicates findings	worksheet for list	of qualifications	and associated	samples when
reported resu	ults do not agree with	nin 10.0% of the recalculated	results.					

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VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1_of_1_
Reviewer:_	JVG,
2nd reviewer:	$\overline{\mathbf{x}}$

SVTA E METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Factor of 2 to account for GPC cleanup

Y	N	N/A
W	N	N/A

%S

2.0

only.

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Conc	entrati	on = $(A_{s})(I_{s})(V_{s})(DF)(2.0)$ $(A_{ls})(RRF)(V_{s})(V_{s})(%S)$	Example:
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D. 10, Chrysine
A _{is}	=	Area of the characteristic ion (EICP) for the specific internal standard	
s	=	Amount of internal standard added in nanograms (ng)	Conc. = (35460)(2-0)(0.5ml)(1600)() (72885)(1.17941)(15.57gx 0.642x)
√ ₀	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	
/ 1	=	Volume of extract injected in microliters (ul)	$=41.2$ ng $k_{\rm G}$
/ _t	=	Volume of the concentrated extract in microliters (ul)	
Of	=	Dilution Factor.	
%S	=	Percent solids, applicable to soil and solid matrices	

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration (以 (内)	Qualification
	10	Chrysene	41.2	41.2	_
	•		·		
				•	
	-	_			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0075	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	J (all detects) UJ (all non-detects)	Α

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0278-BLK1	06/10/20	Hexachlorobenzene	0.42 ug/Kg	All samples in SDG 20F0075

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to no ICV performed, data were qualified as estimated in seven samples.

The quality control criteria reviewed, considered acceptable.	other than th	nose discussed at	pove, were met and are

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Hexachlorobenzene	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)

Duwamish AOC4

Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC	#: 48680B3a VALIDATIC	ON COMPI	LETENES:	S WORKSHEET		Date: 08/04/2
SDG	#: 20F0075 ratory: Analytical Resources, Inc.		age 2B	, , , , , , , , , , , , , , , , , , , ,	ļ	Page: lof / Reviewer: Jyz
		1946 Mathad	20040)			Reviewer:
	HOD: GC Hexachlorobenzene (EPA SW8		·			
	samples listed below were reviewed for eation findings worksheets.	ach of the foll	lowing valida	tion areas. Validation	findings are	noted in attached
	Validation Area			Comme	ents	
<u>ı.</u>	Sample receipt/Technical holding times	SW/A	Cooler to	$emp = 9.6^{\circ}C, 12.8^{\circ}C$		Insufficient time to con
11.	GC Instrument Performance Check	N				
III.	Initial calibration/ICV	A /SW			1cv c	£ 20 }
IV.	Continuing calibration	À	COL	20%		
V.	Laboratory Blanks	SW				
VI.	Field blanks					
VII.	Surrogate spikes	<u> </u>				
VIII.	Matrix spike/Matrix spike duplicates	A				
IX.	Laboratory control samples	<u> </u>	<u>_</u> <u>_</u>	<u>(S</u>		
Χ.	Field duplicates	ND	<u> </u>	4/5		
XI.	Compound quantitation/RL/LOQ/LODs	N				
XII.	Target compound identification	N				
XIII.	System Performance	N				
LXIV	Overall assessment of data	<u> </u>				
Note:	N = Not provided/applicable R = Ri	No compounds o linsate Field blank	detected	D = Duplicate TB = Trip blank EB = Equipment blank	OTHER:	ırce blank :
	Client ID			Lab ID	Matrix	Date
1	LDW20-SC102			20F0075-02	Sediment	06/02/20
2-	LDW20-SC101			20F0075-03	Sediment	06/02/20
3	LDW20-SC117			20F0075-04	Sediment	06/02/20
4-	LDW20-SC123			20F0075-06	Sediment	06/02/20
5	LDW20-SC123FD D		·	20F0075-07	Sediment	06/02/20
1 6	LDW20-SC125			20F0075-08	Sediment	06/02/20
7	LDW20-SC130			20F0075-10	Sediment	06/02/20
8	LDW20-SC102MS		<u> </u>	20F0075-02MS	Sediment	06/02/20

9	LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20	
10_					
Notes	3:				
	BIF0278-Biks				
	I I	<u> </u>			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:			

LDC #: 48680B3a

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_1	of_1_
Reviewer:_	JŲG
2nd Reviewer:	W

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? ___%D or ___%R

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A
<u> </u>							
 							
 							
 							
 						 	
 						 	
	L					<u> </u>	

LDC #:_	48680	B36
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VALIDATION FINDINGS WORKSHEET Blanks

Page:_	of
Reviewer:_	JXG
2nd Reviewer:_	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

lease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".										
Y N N/A Were all samples associated with a method blank?										
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?										
YN N/A If extract clean-up was performed, were extract clean-up blanks analyzed at the proper frequencies?										
Y N N/A Was there	M N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.									
Blank extraction date: 06/10	Mank extraction date: 06/10/20 Blank analysis date: 06/15/20 Associated samples: All (either ND 117 ND)									
Conc. units: Ug /kg	onc. units: UG /kg									
Compound	Blank ID				San	nple Identificati	on			
	BIF0278-1	ek1								
FF	0.42									
	<u> </u>									
Blank extraction date:	Blank analysis	date:		Ass	ociated sample	s:				
Compound	Blank ID				San	nple Identificati	on			

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: All contaminants within five times the method blank concentration were qualified as not detected, "U".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 18, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC102DL	20F0075-02DL	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC121	20F0075-05	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC130DL	20F0075-10DL	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT106MS	20F0075-01MS	Sediment	06/02/20
LDW20-IT106MSD	20F0075-01MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0075	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT106MS/MSD (LDW20-IT106)	Aroclor-1260	-	204 (58-120)	J (all detects)	А

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT106MS/MSD (LDW20-IT106)	Aroclor-1260	60.3 (≤30)	J (all detects)	А

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC123	LDW20-SC123FD	RPD
Aroclor-1248	51.4	59.1	14
Aroclor-1254	70.9	88.2	22
Aroclor-1260	98.7	104	5

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC102	Aroclor-1260	74	J (all detects)	А
LDW20-SC101	Aroclor-1254 Aroclor-1260	41.4 48.8	J (all detects) J (all detects)	А
LDW20-SC125	Aroclor-1248	40.2	J (all detects)	А
LDW20-IT105	Aroclor-1248	42.6	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SC102 LDW20-SC130	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SC102DL LDW20-SC130DL	All compounds except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, MS/MSD %R and RPD, and RPD between two columns, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-IT106 LDW20-SC101 LDW20-SC117 LDW20-SC121 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-IT105 LDW20-IT105	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC102 LDW20-SC130	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	Α	Initial calibration verification (%D)
LDW20-SC102DL LDW20-SC130DL	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-IT106	Aroclor-1260	J (all detects)	Α	Matrix spike/Matrix spike duplicate (%R)(RPD)
LDW20-SC101	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC125 LDW20-IT105	Aroclor-1248	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC102 LDW20-SC130	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-SC102DL LDW20-SC130DL	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B3b VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0075

Stage 2B

Page:__ Reviewer:_ 2nd Reviewer:_

Laboratory: Analytical Resources, Inc.

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comm	ents	Ansulficient
l.	Sample receipt/Technical holding times	SNIA	cooler temps = 9.6℃, 12.	8°C 11.6°C	time to cool
11.	Initial calibration/ICV	A /SW	1 GAL & 20%	1015	202
111	Continuing calibration	A	COV & 20 %		
IV.	Laboratory Blanks	A			
V.	Field blanks	N			
VI.	Surrogate spikes / IS	À/A			
VII.	Matrix spike/Matrix spike duplicates	SW			
VIII.	Laboratory control samples	l A	LC8/D SRM		
IX.	Field duplicates	SW	D = 7/8		
X.	Compound quantitation/RL/LOQ/LODs	SW			
XI.	Target compound identification	N			
ווצ	Overall assessment of data	SW			

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet R:

R = Rinsate FB = Field blank

ND = No compounds detected D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Client ID Lab ID Matrix Date LDW20-IT106 20F0075-01 Sediment 06/02/20 LDW20-SC102 20F0075-02 Sediment 06/02/20 LDW20-SC102RE DL 20F0075-02RE DL 3 Sediment 06/02/20 4 LDW20-SC101 20F0075-03 Sediment 06/02/20 20F0075-04 5 LDW20-SC117 Sediment 06/02/20 6 LDW20-SC121 20F0075-05 Sediment 06/02/20 7 20F0075-06 LDW20-SC123 Sediment 06/02/20 LDW20-SC123FD 20F0075-07 Sediment 06/02/20 9 LDW20-SC125 20F0075-08 Sediment 06/02/20 10 LDW20-IT105 20F0075-09 Sediment 06/02/20 LDW20-SC130 20F0075-10 Sediment 06/02/20 LDW20-SC130RE D 12 20F0075-10BE DL Sediment 06/02/20 13 LDW20-IT127 20F0075-11 Sediment 06/02/20 LDW20-IT106MS 14 20F0075-01MS Sediment 06/02/20 15 LDW20-IT106MSD 20F0075-01MSD Sediment 06/02/20 BIF0228-BIK1

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:		
		· · · · · · · · · · · · · · · · · · ·

LDC #: 48680 \$ 36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of [/] _
Reviewer:_	JДG
2nd Reviewer:	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? —%D or —%R

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

YNN/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCV	1 2c	BB	21.0	All (Det)	T/NJ/A
	, , , , , , , , , , , , , , , , , , ,						(qual Z, AA, BB)
							100, 70

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					·		
					<u> </u>		

LDC#: 48680 B36

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:_	<u></u> of
Reviewer:_	ہاVG
2nd Reviewer:	A

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Was a MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)		MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	14/15	BB	(204 (58-120)	()	1 (Det)	J dets/A
			()	()	6.3 (30)	1/ 1/	
	•	V	()	()	()	V	
			()	()	()		
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				$\frac{1}{3}$	()	()		
\dashv	1.200-1.400		($\frac{\cdot}{\cdot}$	()	()		
			($\frac{\prime}{\cdot}$	()	, ,		

LDC#: 48680B3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer: -

METHOD: GC PCB (EPA SW 846 Method 8082A)
YNNA Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentra		
Compound	7	8	RPD
Aroclor 1248	51.4	59.1	14
Aroclor 1254	70.9	88.2	22
Aroclor 1260	98.7	104	5

V:\Josephine\FIELD DUPLICATES\48680B3b windward duwamish.wpd

LDC #: 48680 B36

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page:	_of	1
Reviewer:	JVG	
2nd Reviewer:		

METHOD: GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

YN N/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Y N N/A Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	ВВ	2	74	J dets (A
	AA	4	41,4	
	BB		48.8	
	Z	9	40.2	
	Z	16	42.6	/

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48 680 B36

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Reviewer: <u>JVG</u>
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated sample	Qualifications
	338	> cal range	2 11	NR/A
			,	
<u> </u>	All except above	di)	3, 12	
			'	
				· ·
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			1	

Comments:	:	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Arsenic	0.025 ug/L	LDW20-SC130 LDW20-IT127

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	А
LDW20-SC109MS/MSD (LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC135	Copper	130 (75-125)	-	J (all detects)	Α

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Analyte	LDW20-SC123	LDW20-SC123FD	RPD
Arsenic	6.35	6.70	5
Cadmium	0.19	0.21	10
Chromium	21.9	23.4	7
Copper	35.3	38.0	7

	Concentra		
Analyte	LDW20-SC123	LDW20-SC123FD	RPD
Lead	16.3	19.8	19
Mercury	0.110	0.126	14
Silver	0.17	0.18	6
Zinc	79.6	83.8	5

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in seven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0075

Sample	Analyte	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC125	Silver Copper	J (all detects) J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

LDC #: 48680B4a SDG #: 20F0075

Laboratory: Analytical Resources, Inc.

Stage 2B

Date: 7/30/20 Page: 1_of_1 Reviewer: AT 2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
Ш.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	From SDG # 20F0039 (LDW20-SC109MS/MSD)
VIII.	Duplicate sample analysis	Α	From SDG # 20F0039 (LDW20-SC109DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	SW	(5,6)
XII.	Internal Standard (ICP-MS)	N_	
XIII.	Sample Result Verification	N _	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable

SW = See worksheet

N = Not provided/applicable

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT106	20F0075-01	Sediment	06/02/20
2	LDW20-SC102	20F0075-02	Sediment	06/02/20
3	LDW20-SC101	20F0075-03	Sediment	06/02/20
4	LDW20-SC117	20F0075-04	Sediment	06/02/20
5	LDW20-SC123	20F0075-06	Sediment	06/02/20
6	LDW20-SC123FD	20F0075-07	Sediment	06/02/20
7	LDW20-SC125	20F0075-08	Sediment	06/02/20
8	LDW20-IT105	20F0075-09	Sediment	06/02/20
9	LDW20-SC130	20F0075-10	Sediment	06/02/20
10	LDW20-IT127	20F0075-11	Sediment	06/02/20_
11				
12				
13				

Notes:	 	
	 141114	

LDC #: 48680B4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1	of	1
Reviewer:	А٦	L

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2 to 7, 9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,8,10	As
	Analysis Method
ICP	
ICP-MS	
CVAA	

LDC #: 48680B4a

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 9,10

					Sample Identification							
Analyte	PB (units)	Maximum ICB/CCB (ug/L)	Action Level									
As		0.025										
					_							
				<u>-</u>								

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
LDW20-SC109	S	Ag	41.5		75-125			2 to 7, 9	J/UJ/A	Det
		Cu	130		75-125			2 to 7, 9	Jdet/A	Det
					-			<u> </u>		
			1							
				 			 			

Comments:

LDC #: 48680B4a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer: ATL

Method: Metals

Analyte	Concentrati	on (mg/kg)	RPD	Our life are (Personte Outle)
	5	6		Qualifiers (Parents Only)
Arsenic	6.35	6.70	5	
Cadmium	0.19	0.21	10	
Chromium	21.9	23.4	7	
Copper	35.3	38.0	7	
Lead	16.3	19.8	19	
Mercury	0.110	0.126	14	
Silver	0.17	0.18	6	
Zinc	79.6	83.8	5	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC121	20F0075-05	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT106DUP	20F0075-01DUP	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0075

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concen		
Analyte	LDW20-SC123	LDW20-SC123FD	RPD
Total solids	58.50	58.13	1
Total organic carbon	1.63	1.67	2

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

LDC #: 48680B6 SDG #: 20F0075

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 7/30/20 Page: 1 of 1 Reviewer: 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	alidation infulligs worksheets.							
	Validation Area		Comments					
J.	Sample receipt/Technical holding times	A/A						
II	Initial calibration	A						
111.	Calibration verification	Α						
IV	Laboratory Blanks	sw						
V	Field blanks	N						
VI.	Matrix Spike/Matrix Spike Duplicates	А	From SDG # 20F0039 (LDW20-SC109MS)					
VII.	Duplicate sample analysis	Α	12, From SDG # 20F0039 (LDW20-SC109DUP)					
VIII.	Laboratory control samples	Α	LCS/SRM					
IX.	Field duplicates	sw	(6,7)					
X.	Sample result verification	N						
XI.	Overall assessment of data	А						

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Client ID Lab ID Matrix Date 20F0075-01 Sediment 06/02/20 LDW20-IT106 2 LDW20-SC102 20F0075-02 Sediment 06/02/20 3 LDW20-SC101 20F0075-03 Sediment 06/02/20 LDW20-SC117 20F0075-04 Sediment 06/02/20 LDW20-SC121 20F0075-05 Sediment 06/02/20 5 Sediment 06/02/20 LDW20-SC123 20F0075-06 6 20F0075-07 Sediment 06/02/20 LDW20-SC123FD Sediment 06/02/20 8 LDW20-SC125 20F0075-08 20F0075-09 Sediment 06/02/20 9 LDW20-IT105 20F0075-10 Sediment 06/02/20 10 LDW20-SC130 06/02/20 20F0075-11 Sediment 11 LDW20-IT127 20F0075-01DUP LDW20-IT106DUP Sediment 06/02/20 12 13 14

Notes:	 		

LDC #: 48680B6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 11	TS, TOC	
QC		
12	TS	

LDC #: 48680B6

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: all

				Sample Identification						
Analyte	PB (units)	Maximum ICB/CCB (%)	Action Level							
TOC		0.02								
					_					

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised

LDC#: 48680B6

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

	Concentr	ration (%)			
Analyte	6	7	RPD	Qualifiers (Parents Only)	
Total Solids	58.50	58.13	1		
Total Organic Carbon	1.63	1.67	2		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Polychlorinated Dioxins/Dibenzofurans

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date	
LDW20-SC130	20F0075-10	Sediment	06/02/20	
LDW20-IT127	20F0075-11	Sediment	06/02/20	

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported at 11.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0075	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0075

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SC130	1,2,3,7,8-PeCDD	0.582 ng/Kg	0.582U ng/Kg
LDW20-IT127	1,2,3,7,8-PeCDD	0.871 ng/Kg	0.871U ng/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0075	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated in two samples.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC130 LDW20-IT127	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-SC130 LDW20-IT127	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0075

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC130	1,2,3,7,8-PeCDD	0.582U ng/Kg	Α
LDW20-IT127	1,2,3,7,8-PeCDD	0.871U ng/Kg	Α

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

DG#	:48680B21VALIDATIO t:20F0075 atory:_Analytical Resources, Inc.		PLETENESS WO Stage 2B	ORKSHEE	Re	Date: 08/07/2 Page: 1 of
ne sa	OD: HRGC/HRMS Polychlorinated Dioxi amples listed below were reviewed for ea ion findings worksheets.		·	·		
	Validation Area	<u> </u>		Com	ments	
<u>l.</u>	Sample receipt/Technical holding times	SW/A	Cooler temp = 11.6 de	eg C	(Insufficient time	to cool)
II.	HRGC/HRMS Instrument performance check	Α				
Ш.	Initial calibration/ICV	A/A	ICAL ≤ 20/35°	%	ICV ≤ C	QC Limits
IV.	Continuing calibration	sw	CCV ≤ QC Lir	nits		
V.	Laboratory Blanks	sw				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N				
VIII.	Laboratory control samples	Α	OPR, SRM			
IX.	Field duplicates	N				
Χ.	Labeled Compounds	Α				
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jde	ets/A		
XII.	Target compound identification	N				
XIII.	System performance	N				
(IV.	Overall assessment of data	A				
te:	N = Not provided/applicable R = Rin	o compound sate eld blank	TB	= Duplicate = Trip blank = Equipment bla	SB=Sourd OTHER: ank	ce blank
0	Client ID		Lab	ID	Matrix	Date
_ L	DW20-SC130		20F	0075-10	Sediment	06/02/20
	_DW20-IT127		20F	0075-11	Sediment	06/02/20
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es:						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:			 	 	

LDC #: 48680B21

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	<u>1_of_1_</u>
Reviewer:_	JVG
2nd Reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- <u>Y</u> <u>N</u> <u>Y</u>
- Was a routine calibration performed at the beginning of each 12 hour period?
 Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits	Finding Ion	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
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LDC #: 48680B21

VALIDATION FINDINGS WORKSHEET Blanks

	Page .	_1_of_1_
	Reviewer:	JVG
2nd	Reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

 $\frac{\frac{Y}{Y}}{\frac{Y}{Y}}$ Were all samples associated with a method blank?

Was a method blank performed for each matrix and whenever a sample extraction was performed?

Was the method blank contaminated?

Blank extraction date: Blank analysis date: 06/25/20 06/22/20 Associated samples:_ Conc. units: na/Ka

Compound	Blank ID			Sample Identification							
	BIF0465-BLK1	(5x)	1	2							
В	0.175	0.88	0.582*/U	0.871/U							
М	0.0946*	0.47									
0	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
S S											

*EMPC

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC140MS	20F0094-02MS	Sediment	06/03/20
LDW20-SC140MSD	20F0094-02MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.5°C, 10.0°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/ Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0403-SRM	Anthracene	56.3 (57-143)	All samples in SDG 20F0094	J (all detects)	Р

X. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC211	LDW20-SC211FD	RPD
Naphthalene	8.7	7.7	12
2-Methylnaphthalene	9.4	8.8	7
Acenaphthylene	7.1	7.6	7
Dimethylphthalate	16.6	12.9	25
Acenaphthene	5.7	6.3	10
Dibenzofuran	6.5	6.9	6
Fluorene	19.9	20.0U	Not calculable

	Concentra	Concentration (ug/Kg)		
Compound	LDW20-SC211	LDW20-SC211FD	RPD	
Phenanthrene	78.1	73.6	6	
Anthracene	19.8	18.3	8	
Fluoranthene	181	178	2	
Pyrene	239	225	6	
Butylbenzylphthalate	21.8	30.0	32	
Benzo(a)anthracene	86.8	85.4	2	
Chrysene	126	127	1	
Bis(2-ethylhexyl)phthalate	185	180	3	
Benzofluoranthenes, total	280	271	3	
Benzo(a)pyrene	120	120	0	
Indeno(1,2,3-cd)pyrene	78.8	71.7	9	
Dibenzo(a,h)anthracene	24.8	27.5	10	
Benzo(g,h,i)perylene	84.3	79.3	6	

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211	Anthracene	J (all detects)	Р	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680C2a SDG #: 20F0094

Stage 2B

Reviewer: 2nd Reviewer

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	
1.	Sample receipt/Technical holding times	SAIA	Cooler temps = 10,0°C 9,5°C 12,6°C (Insuffici	ent co
II.	GC/MS Instrument performance check	Δ΄	, , , , , , , , , , , , , , , , , , , ,	
III.	Initial calibration/ICV	AA	10ALE 20% 10VE 30B	
IV.	Continuing calibration	A	CA = 20%	
V.	Laboratory Blanks	\ A		
VI.	Field blanks	N.		
VII.	Surrogate spikes	À		
VIII.	Matrix spike/Matrix spike duplicates	A		
IX.	Laboratory control samples	ŚW	LG SRM	
X.	Field duplicates	SW	p = 7/8	
XI.	Internal standards	A		
XII.	Compound quantitation RL/LOQ/LODs	N		
XIII.	Target compound identification	N		
XIV.	System performance	Z		
XV.	Overall assessment of data	A		

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected R = Rinsate FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC140	20F0094-02	Sediment	06/03/20
2	LDW20-SC142	20F0094-03	Sediment	06/03/20
3	LDW20-SC150	20F0094-04	Sediment	06/03/20
4	LDW20-SC135	20F0094-07	Sediment	06/03/20
5	LDW20-SC202	20F0094-08	Sediment	06/03/20
6	LDW20-SC203	20F0094-09	Sediment	06/03/20
7	LDW20-SC211	20F0094-10	Sediment	06/03/20
8	LDW20-SC211FD \mathcal{D}	20F0094-11	Sediment	06/03/20
9	LDW20-SC140MS	20F0094-02MS	Sediment	06/03/20
10	LDW20-SC140MSD	20F0094-02MSD	Sediment	06/03/20
11				
12				
13	BIFO403-BULL			
14_				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachiorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48680 C26

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> / S R M

Page:	of	
Reviewer:	J\(C	<u>3</u>
2nd Reviewer:		_

METHOD: GC/MS BNA (EPA SW 846 Method 82702)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a LCS required?

N N/A

Were the LCS/LCSD required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0463-5RM	, V V	56.3 (57-43)	()	()	All (Det)	J/UJ/P
			()	()	()		/
			()	()	()		
			()	()	()		
			()	()	()		
			()	()	()		
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LDC#: 48680C2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)
YNNA Were field duplicate pairs identified in this SDG?

YNNA Were target analytes detected in the field duplicate pairs?

	Concentration (ug/Kg)		
Compound	7	8	RPD
s	8.7	7.7	12
w	9.4	8.8	7
DD	7.1	7.6	7
СС	16.6	12.9	25
GG	5.7	6.3	10
JJ	6.5	6.9	6
NN	19.9	20.0U	NC
υu	78.1	73.6	6
vv	19.8	18.3	8
YY	181	178	2
ZZ	239	225	6
AAA	21.8	30.0	32
ccc	86.8	85.4	2
DDD	126	127	1
EEE	185	180	3
A2	280	271	3
Ш	120	120	0
JJJ	78.8	71.7	9
ккк	24.8	27.5	10
LLL	84.3	79.3	6

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211	J (all detects) UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/20/20	Benzoic acid Pentachlorophenol	37.8 58.9	LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Α

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (ug/Kg)		
Compound	LDW20-SC211	LDW20-SC211FD	RPD
1,4-Dichlorobenzene	1.7	1.6	6
Benzyl alcohol	9.8	7.7	24
Benzoic acid	34.8	30.9	12

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and continuing calibration %D, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Α	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680C2b

SDG #: 20F0094

Stage 4

Reviewer: 2nd Reviewer:

Laboratory: Analytical Resources, Inc.

SVOA

METHOD: GC/MS Polynuclear Arematic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	SMIA	Cooler temps = 10.0°C, 9.5°C 12.0°C Insufficient
II.	GC/MS Instrument performance check	A	Time to each
III.	Initial calibration/ICV	AISW	10AL = 201. W 10V = 30 B
IV.	Continuing calibration	SW	CCV 20 3
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
iX.	Laboratory control samples	Á	US, SRM
X.	Field duplicates	SW	p = 8/9
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Δ	
XIII.	Target compound identification	Δ	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note:

A = Acceptable N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

20F0094-01MS

20F0094-01MSD

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Client ID Lab ID Matrix Date LDW20-ITT133 20F0094-01 Sediment 06/03/20 20F0094-02 06/03/20 LDW20-SC140 Sediment 3 LDW20-SC142 20F0094-03 Sediment 06/03/20 LDW20-SC150 20F0094-04 Sediment 06/03/20 5 LDW20-SC135 20F0094-07 Sediment 06/03/20 6 LDW20-SC202 20F0094-08 Sediment 06/03/20 20F0094-09 LDW20-SC203 Sediment 06/03/20 20F0094-10 8 LDW20-SC211 Sediment 06/03/20 9 LDW20-SC211FD 20F0094-11 Sediment 06/03/20 LDW20-IT139 20F0094-13 10 Sediment 06/03/20 11 LDW20-IT151 20F0094-14 Sediment 06/03/20 20F0094-15 12 LDW20-IT146 Sediment 06/03/20

- 1. BFI0371- BUKI

LDW20-ITT133MS

LDW20-ITT133MSD

13 /

-2. BI F0413_ put2

1 10-12 CPAH =

06/03/20

06/03/20

Sediment

LDC#: 48680 C26

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2 Reviewer: JV 2nd Reviewer:_

メット Method: PAH (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			Α
Was cooler temperature criteria met?				
II. GC/MS Instrument performance check (Not required)	-			
Were the DFTPP performance results reviewed and found to be within the specified criteria?				
Were all samples analyzed within the 12 hour clock criteria?				
Illa. Initial calibration	/	<u> </u>		
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) \leq 20% and relative response factors (RRF) \geq 0.05?				;
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of \geq 0.990?				
IIIb. Initial Calibration Verification	Г	, 		
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?				·
Were all percent differences (%D) ≤30%?				
IV. Continuing calibration		ı. — T		
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?				
Were all percent differences (%D) \leq 20% and relative response factors (RRF) \geq 0.05?				
V. Laboratory Blanks	, 			
Was a laboratory blank associated with every sample in this SDG?	4			
Was a laboratory blank analyzed for each matrix and concentration?				
Was there contamination in the laboratory blanks?		1		
VI. Field blanks	· P	K/		
Were field blanks identified in this SDG?	N			
Were target compounds detected in the field blanks?				
VII. Surrogate spikes	·—— —————			
Were all surrogate percent differences (%R) within QC limits?				
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?				
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?				
VIII. Matrix spike/Matrix spike duplicates	/ 1		,	
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			,	

LDC#: 48680 C2b

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: JVG
2nd Reviewer: _____

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples		/		
Was an LCS analyzed per extraction batch?	7			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				3
X. Field duplicates	,			
Were field duplicate pairs identified in this SDG?				·
Were target compounds detected in the field duplicates?				
XI. Internal standards	<u>, </u>			
Were internal standard area counts within -50% or +100% of the associated calibration standard?			·	
Were retention times within ± 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	7			
XIII. Target compound identification				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				
Were chromatogram peaks verified and accounted for?				
XIV. System performance	· <u></u>			
System performance was found to be acceptable.				
XV. Overall assessment of data				,
Overall assessment of data was found to be acceptable.				

LDC #:	48	6	80C26	
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VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u></u> of
Reviewer:_	JVG
2nd Reviewer:_	

SVA- E METHOD: GC/MS PAH (EPA SW 846 Method 8270Ø-SJM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

	YN	I) N/A	Were a	all %D with	in the validation	n criteria of	f ≤20/30% '	%D	?
--	----	--------	--------	-------------	-------------------	---------------	-------------	----	---

#	Date	Standard ID	Compound	Finding %D (Limit: <u><20.</u> 0%(30%)	Associated Samples	Qualifications		
		SIC0029-SCV1	QQ.	34.4	2-9 MB2 (ND+Det)	J/43/A		
						· · · · · · · · · · · · · · · · · · ·		
		·			·			
								
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LDC #: 48680 C 26

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	of
Reviewer:	JУG
2nd Reviewer:	4

METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N/A

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

YI	<u>1)N/A</u> V	Vere percent difference	es (%D) ≤20) % and rel	ative response facto	rs (RRF) within the me	
	D-4-	04 4 445			Finding %D	Finding RRF	

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/20/20	NT1006 20635	PPP	37.8		2-9 MB2 (N)+	Pet) J/UJ/A
	,		T+	58.9			3/ VI3/ H
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LDC#: 48680C2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrat			
Compound	8	9	RPD	
Е	1.7	1.6	6	
QQQ	9.8	7.7	24	
PPP	34.8	30.9	12	

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LDC #: 48680C2b

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: 1_of_1
Reviewer: JVG
2nd Reviewer: ______

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound	(IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	02/28/20	1,4-DCB	(DCB)	1.31443	1.31443	1.41049	1.41049	10.3	10.3
	SIM		1,2,4-TCB	(NPT)	0.36297	0.36297	0.40284	0.40284	12.2	12.2
ļ	NT10		Pentachlorophenol	(PHN)	0.19257	0.19257	0.16863	0.16863	11.6	11.6

# 5	Standard ID	Calibration Date	Compoun	d (IS)	Reported RRF (RRF 2.5 std)	Recalculated RRF (RRF 2.5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
2	ICAL SIM NT8		Chrysene Benzo(a)pyrene	(CRY) (PRY)	1.22429 1.17321	1.22429 1.17321	1.17941 1.08195	1.17941 1.08195	5.1 9.9	5.1 9.9

LDC # 48680C2a

VALIDATION FINDINGS WORSHEET <u>Continuing Calibration Calculation Verification</u>

Page:_	<u>1</u> of <u>1</u>
Reviewer:	JVG
2nd Reviewer:	

Cx = Concentration of compound,

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

Where:

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF Ais = Area of associated internal standard

Ax = Area of compound, Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT10062003S	6/20/2020	1,4-DCB	(DCB)	1.41049	1.37278	1.37278	2.7	2.7
			1,2,4-TCB	(NPT)	0.40284	0.41085	0.41085	2.0	2.0
	NT10		Pentachlorophenol	(PHN)	0.16863	0.06929	0.06929	58.9	58.9
2	N820061702	6/17/2020	Chrysene	(CRY)	1.17941	1.15108	1.15108	2.4	2.4
	NT8		Benzo(a)pyrene	(PRY)	1.08195	1.02197	1.01383	6.3	6.3

LDC #:__ 48680 C26

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:	1_of_1
Reviewer:_	
2nd reviewer:	25

METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID: #

		Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	W-dlo	3.00	1-978	65.9	65.9	0
2-Fluorobiphenyl	KKK- 04		2. 74 9	91.6	91.3	
Ter phonyl- d14	YY-d10	1	2.224	74.	74.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

·	Surrogate Spiked	` Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl				• ·	
Terphenyl-d14					

Sample ID:___

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl		·			
Terphenyl-d14					

Sample ID:

·	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

Page:_	<u>1_of_1_</u>
Reviewer:	JVG
2nd Reviewer:	0

SVOA METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples:

Compound		ike ded (c)	Sample Concentration	Conce	Sample entration	Matrix Percent F		Matrix Spike			MSD PD
	MS	MSD		MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Acenaphthene						·			·		
Pyrene Benzo (a) pyrene	300	<i>ት</i> መ	21.3	324	310	101	10]	96.4	96.4	4.19	4.42
										<i>A</i>	
								-	·		

Comments: Refer to Matrix Spike/Matrix Spike Duplica	<u>tes findings worksheet for list of qualifications and</u>	associated samples when reported results do not agree within
10.0% of the recalculated results.		
,		
	3	

LDC #:	48	680	CZP
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VALIDATION FINDINGS WORKSHEET Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page:_1	ori
Reviewer:_	J∖⟨G

	Reviewer:_	JXG
2nd	Reviewer.	0

SYDA METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration

SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

BI F0403- B52 LCS/LCSD samples:

	Sı	oike Ided	Spike Concentration			is		SD.	L CS/L CSD	
Compound		1kg)	(4	(kg)	Percent I	Recovery	Percent	Recovery	RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene										
Pyrene									•	`
PCP	1500	NA	916	NA	61.0	61.0				
									÷	

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated sample.	nples when
reported results do not agree within 10.0% of the recalculated results.	

LDC #: 48680 CZB

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1_of_1_
Reviewer:_	JVG)
2nd reviewer:	3

METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

R	N(N/A
V	N	N/A

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration	=	$(A_{*})(I_{*})(V_{*})(DF)(2.0)$
	(A	; <u>)(RRF)(V;)(V;)(%S)</u>

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

V_I = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

2.0 = Factor of 2 to account for GPC cleanup

=	xa	m	nl	•
_	λd	111	μ	כ,

Sample I.D. _____, ___ Chry sene

Conc. = $\frac{(27114)(20)(0.5mL)(100)}{(64278)(1.17941)(13.79)(0.7367)}$

= 35.73 kg/kg

#	Sample ID	Compound	Reported Concentration	Calculated Concentration (45/kg	Qualification
	[Chrysene	35.7	35.7	
			·		
				·	
			·		
				·	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC142MS	20F0094-03MS	Sediment	06/03/20
LDW20-SC142MSD	20F0094-03MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0094	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	Α

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to no ICV performed, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Hexachlorobenzene	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680C3a

SDG #: 20F0094

Stage 2B

2nd Reviewer:

Laboratory: Analytical Resources, Inc.

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	
1.	Sample receipt/Technical holding times	SW/A	Coster temps = 10.0°C, 9.5°C 12.0°C (Insaffic Time to	ies
II.	GC Instrument Performance Check	l N		6
III.	Initial calibration/ICV	A ISW	1946 203 WEZOS	
IV.	Continuing calibration	A	1946 203 104 203 CON = 20%	
V.	Laboratory Blanks	À		
VI.	Field blanks	N		
VII.	Surrogate spikes //S	A/A		
VIII.	Matrix spike/Matrix spike duplicates	A		
IX.	Laboratory control samples	A	LCS	
X.	Field duplicates	ND	D = 7/8	
XI.	Compound quantitation/RL/LOQ/LODs	N		
XII.	Target compound identification	N		l
XIII.	System Performance	N		
XIV	Overall assessment of data	A		

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Client ID	Lab ID	Matrix	Date
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD D	20F0094-11	Sediment	06/03/20
LDW20-SC142MS	20F0094-03MS	Sediment	06/03/20
0 LDW20-SC142MSD	20F0094-03MSD	Sediment	06/03/20
1			

BIF 0353- BULL			

LDC #: 48680C3a

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:	<u>1_of_1_</u>
Reviewer:_	⁄d y G∕
2nd Reviewer:	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed?.___%D or ____%R

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N(N/A) Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A
							
<u> </u>							
 							
<u> </u>							
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC156	20F0094-05	Sediment	06/03/20
LDW20-SC162	20F0094-06	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC144	20F0094-12	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0094	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-ITT133MS/MSD (LDW20-ITT133)	Aroclor-1260	-	126 (58-120)	J (all detects)	Α

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC211	LDW20-SC211FD	RPD
Aroclor-1248	47.9	55.5	15
Aroclor-1254	67.2	78.0	15
Aroclor-1260	82.2	54.3	41

X. Compound Quantitation

All compound quantitations met validation criteria.

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC135	Aroclor-1248	44.9	J (all detects)	А
LDW20-SC211FD	Aroclor-1248 Aroclor-1260	48.9 44.9	J (all detects) J (all detects)	A
LDW20-IT139	Aroclor-1248	54.2	J (all detects)	А
LDW20-IT151	Aroclor-1248	48.5	J (all detects)	Α
LDW20-IT146	Aroclor-1248	46.8	J (all detects)	А

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, MS/MSD %R, and RPD between two columns, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-ITT133 LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC156 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211 LDW20-SC144 LDW20-IT139 LDW20-IT139 LDW20-IT151 LDW20-IT146	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-ITT133	Aroclor-1260	J (all detects)	Α	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC135	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-SC211FD	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT139	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT151	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT146	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Laboratory: Analytical Resources, Inc.

LDC #: 48680C3b

SDG #: 20F0094

Reviewer: 2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	(Insufficie
I.	Sample receipt/Technical holding times	SW/A	Coder temps = 10.0°C 9.5°C	12.000 time to
11.	Initial calibration/ICV	A ISW	1CAL = 20%	1015 20 %
101.	Continuing calibration	A	COV = 20 %	
IV.	Laboratory Blanks	À		
V.	Field blanks	17		
VI.	Surrogate spikes /15	A/A		
VII.	Matrix spike/Matrix spike duplicates	SW		
VIII.	Laboratory control samples	_ A	ucs b SRM	
IX.	Field duplicates	SW	D = 10/11	
X.	Compound quantitation/RL/LOQ/LODs	SW		
XI.	Target compound identification	A		
XII	Overall assessment of data	A		

Note: A = Acceptable

N = Not provided/applicable

R = Rinsate

ND = No compounds detected

D = Duplicate TB = Trip blank SB=Source blank OTHER:

FB = Field blank SW = See worksheet EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-ITT133	20F0094-01	Sediment	06/03/20
2	LDW20-SC140	20F0094-02	Sediment	06/03/20
3	LDW20-SC142	20F0094-03	Sediment	06/03/20
4	LDW20-SC150	20F0094-04	Sediment	06/03/20
5	LDW20-SC156	20F0094-05	Sediment	06/03/20
6	LDW20-SC162	20F0094-06	Sediment	06/03/20
7	LDW20-SC135	20F0094-07	Sediment	06/03/20
8	LDW20-SC202	20F0094-08	Sediment	06/03/20
9	LDW20-SC203	20F0094-09	Sediment	06/03/20
10	LDW20-SC211 D	20F0094-10	Sediment	06/03/20
11	LDW20-SC211FD D	20F0094-11	Sediment	06/03/20
12	LDW20-SC144	20F0094-12	Sediment	06/03/20
13	LDW20-IT139	20F0094-13	Sediment	06/03/20
14	LDW20-IT151	20F0094-14	Sediment	06/03/20
15	LDW20-IT146	20F0094-15	Sediment	06/03/20
16	LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
17	LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

VALIDATION FINDINGS CHECKLIST

Page: 1_ of _1_ Reviewer: __JVG 2nd Reviewer: ____

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Mountain Consider (Environmental consideration)								
Validation Area	Yes	No	NA	Findings/Comments				
I. Technical holding times	/							
Were all technical holding times met?		<u> </u>						
Was cooler temperature criteria met?								
II. GC/ECD Instrument performance check				T				
Was the instrument performance found to be acceptable?	<u> </u> '	<u> </u>						
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?			/					
Were endrin and 4,4'-DDT breakdowns \leq 15% for individual breakdown in the Evaluation mix standards?								
Illa. Initial calibration	. 	,						
Did the laboratory perform a 5 point calibration prior to sample analysis?								
Were all percent relative standard deviations (%RSD) ≤ 20%?								
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?								
Were the RT windows properly established?				3				
IIIb. Initial calibration verification								
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?								
Were all percent differences (%D) ≤ 20%?								
IV. Continuing calibration			·					
Was a continuing calibration analyzed daily?	/							
Were all percent differences (%D) ≤ 20%?	//							
Were all the retention times within the acceptance windows?								
V. Laboratory Blanks								
Was a laboratory blank associated with every sample in this SDG?								
Was a laboratory blank analyzed for each matrix and concentration?		لِــاً						
Was there contamination in the laboratory blanks?								
VI. Field blanks			<u> </u>					
Were field blanks identified in this SDG?								
Were target compounds detected in the field blanks?								
VII. Surrogate spikes/Internal Standards		,						
Were all surrogate percent recovery (%R) within the QC limits?								
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?								

LDC #:	¥	४	Ĺ	80	C3b
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VALIDATION FINDINGS CHECKLIST

Page: 1_of 2 Reviewer: __JVG 2nd Reviewer: ___

Validation Area	Yes	No	NA	Findings/Comments
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?				
Were internal standard area counts within \pm 50% of the average area calculated during calibration?		_		
VII. Matrix spike/Matrix spike duplicates		,		
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
IX. Laboratory control samples		/		
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		\		
X. Field duplicates	•	/		
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Compound quantitation	•			
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	/			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?				
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?				
XIII. Overall assessment of data	-	/		
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	amma-BHC N. Endosulfan sulfate X. Aroclor-1232		HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	eldrin S. alpha-Chlordane CC. 2,4'-DDD		MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	xx.

Notes:	

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	\mathcal{T}°	f1
Reviewer:_	ىلا	/G
2nd Reviewer:		

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? _____%D or ______%R

N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%? Y(N)N/A

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SI F0 176 - SOV	1 20	BB	21.0	All (bet)	J/uJ/X
		·					J/NJ/A (qual Z, AA, BB)
			\				
_							
							·
						·	

LDC #:____48680 C36

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:__of_	_1
Reviewer: JVG	
2nd Reviewer:	
-1 /	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

√AN N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Was a MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed? N N/A N/A

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)		MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	16/17	BB	(1	26 (58-120)		I (halo	J dets/A
	16 / 1/			 '	(58 -120)		1 (bet)	J 2117/A
 			, ,	+	()	, ,		
			(+				
			()	+		, ,		
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			(_	()	()		
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LDC#: 48680C3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GC PCB (EPA SW 846 Method 8082A)

YN NA Were field duplicate pairs identified in this SDG? Y/WNA

Were target analytes detected in the field duplicate pairs?

	Concentration (ug/Kg)		
Compound	10	11	RPD
Aroclor 1248	47.9	55.5	15
Aroclor 1254	67.2	78.0	15
Aroclor 1260	82.2	54.3	41

V:\Josephine\FIELD DUPLICATES\48680C3b windward duwamish.wpd

LDC #: 48 \$ 80 C35

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: _	(_of\	
Reviewer: _	JVG	
2nd Reviewer:	1	

METHOD: / GC _ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y/N N/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Y N N/A

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors ≤40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	7	44, 9	J dets A
	Z	11	48.9	
	βB		44.9	
	Z	3	54.2	
	Z	14	48,5	
	Z	15	46.8	<u> </u>
				·

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680C3b

VALIDATION FINDINGS WORKSHEET **Initial Calibration Calculation Verification**

Page: <u>1</u>	_ of	1
Reviewer:_	JV,(3
2nd Reviewer:		/

METHOD: GC PCBs (EPA SW 846 Method 8082A)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

		Calibration		Reported RRF	Recalculated RRF	Reported Average RRF	Recalculated Average RRF	Reported %RSD	Recalculated %RSD
#	Standard ID	Date	Compound (IS)	(250 std)	(250 std)	(Initial)	(Initial)	<u> </u>	
1	ICAL	6/10/2020	1260-1 ZB5 (HBP)	0.03748	0.03748	0.03633	0.03633	1.944	1.946
	ECD7		1260-1 ZB35 (HBP)	0.04683	0.04683	0.04865	0.04865	13.540	13.537

LDC # <u>48680C3b</u>

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration Calculation Verification</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC PCBs (EPA SW 846 Method 8082A)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

Where:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

Ax = Area of compound,

Cx = Concentration of compound,

Ais = Area of associated internal standard

Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Conc	Reported Conc (CCV)	Recalculated Conc (CCV)	Reported % D	Recalculated %D
1	20061804ECD7	6/17/2020	1260-1 ZB5 (HBP)	250.0	254.5	254.5	1.8	1.8
			1260-1 ZB35 (HBP)	250.0	261.9	261.9	4.7	4.7
2	20061821ECD7	6/17/2020	1260-1 ZB5 (HBP)	250.0	266.7	266.7	6.7	6.7
			1260-1 ZB35 (HBP)	250.0	284.9	284.9	13.9	13.9
3	20061833ECD7.	6/18/2020	1260-1 ZB5 (HBP)	250.0	277.1	277.1	10.9	10.9
			1260-1 ZB35 (HBP)	250.0	293.4	293.4	17.4	17.4
4	20061903ECD7	6/19/2020	1260-1 ZB5 (HBP)	250.0	250.5	250.5	0.2	0.2
			1260-1 ZB35 (HBP)	250.0	258.3	258.3	3.3	3.3

LDC #:_ 48680 C 36

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:_	1	_of_	1
Reviewer:_		JV	3
2nd reviewer:_	_		5

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The p	ercent recoveries	(%R)	of surrogates were	e recalculated for the c	ompounds identified	below using	g the following	calculation:
-------	-------------------	------	--------------------	--------------------------	---------------------	-------------	-----------------	--------------

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	Co 1	40.0	6.8 (5)	84.6	85	9
Tetrachloro-m-xylene		1				
Decachlorobiphenyl	CHI		8,0(5)	(00)	100	1
Decachlorobiphenyl						

Sample ID:_____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:_			

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

	Page:_	1	_of	_1
	Reviewer:_		J	3
2nd	Reviewer:_	(V	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below
using the following calculation:

% Recovery =	100*	(SSC-SC)/SA
--------------	------	---------	------

Where: SSC = Spiked sample concentration SA = Spike added

SC = Concentration

RPD = I MS - MSD I * 2/(MS + MSD)

MS = Matrix spike percent recovery

MSD = Matrix spike duplicate percent recovery

MS/MSD samples:___

		pike	Sample		d Sample	Matrix	Spike	Matrix Spil	ce Duplicate	MS/	MSD
Compound		ided (Kg.)	Concentration (以ん)		entration	Percent	Recovery	Percent	Recovery	R	PD
	MS	MSD		MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC											
4,4'-DDT											
Aroclor 1260	101	101	69.5	179	197	108	108	126	126	9.82	9-57
									ernande d'Arthur		
							MADURA.				

Comments:	Refer ot Matrix Spike/Matrix	Spike Duplicates findings	worksheet for list of	f qualifications and	<u>associated samples w</u>	<u>/hen reported res</u>	<u>ults do not agre</u>	<u>ee within</u>
10.0% of the	recalculated results.	_					_	

LDC #: 48680 C36

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification</u>

Page:_1	of_1_
Reviewer:_	JVG
2nd Reviewer:	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: BIFU 320 - BSI

		Spike		d Sample		.cs	L	CSD	LCS	S/LCSD
Compound	()	Ndded Vy/kc)		entration (5/kg)	Percent	Recovery	Percent	Recovery	. F	RPD
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
Aroclor 1260	101	101	86.2	95.6	85,5	87.5	94.8	947	18-4	10.3

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported
esults do not agree within 10.0% of the recalculated results.

LDC #:____48680C36

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	<u>1_</u> of_1_
Reviewer:	J V /G
2nd reviewer:	6

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

\mathcal{N}	Ν	N/A
	N	N/A

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{\text{(A) (Fv) (Df)}}{\text{(RF) (Vs or Ws) (\%S/100)}}$

A = Area of compound Fv = Final Volume of extract Df = Dilution Factor RF = Average Response Factor of compound in ICal

Vs = Initial Volume of sample Ws = Initial Weight of sample

%S = Percent Solid

Sample I.D.
$$\frac{1}{260}$$
 Col. |

 $1260-1$
 $1260-1$
 1260 (80)
 $1260-1$
 1260 (80)
 1260 (80)
 1260 (80)
 1260 Avc = $\frac{72.7}{1260}$ + $\frac{1260}{12.7}$ + $\frac{1260}{12.7}$ Avc = $\frac{72.7}{1260}$ + $\frac{1260}{12.7}$ + $\frac{1260}{12.7}$ Avc = $\frac{1260}{12.7}$ + $\frac{1260}{$

#	Sample ID	Compound	Reported Concentration (પ્ય / મિન્	Calculated Concentration (५५ दि)	Qualification
		1260	69,5	69.50	
	*		'		

Note:	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 18, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Arsenic	0.025 ug/L	All samples in SDG 20F0094

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC201 LDW20-SC211 LDW20-SC211FD)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	A
LDW20-SC109MS/MSD (LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC201 LDW20-SC211 LDW20-SC211	Copper .	130 (75-125)	•	J (all detects)	Α

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Analyte	LDW20-SC211	LDW20-SC211FD	RPD
Arsenic	9	8.06	11

	Concentra		
Analyte	LDW20-SC211	LDW20-SC211FD	RPD
Cadmium	0.33	0.29	13
Chromium	25.9	23.8	8
Copper	46.2	40.7	13
Lead	25.9	25.6	1
Mercury	0.130	0.146	12
Silver	0.32	0.29	10
Zinc	104	93.0	11

XII. Internal Standards (ICP-MS)

Internal standard data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0094

Sample	Analyte	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Silver Copper	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680C4a SDG #: 20F0094

Stage 2B

Date: 7/30/20 Page: 1 of 1 Reviewer: A 2nd Reviewer:_

Laboratory: Analytical Resources, Inc.

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
111.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	From SDG # 20F0039 (LDW20-SC109MS/MSD), SDG # 20F0109 (LDW20-SC214MS/MSD)
VIII.	Duplicate sample analysis	Α	From SDG # 20F0039 (LDW20-SC109DUP), SDG # 20F0109 (LDW20-SC214DUP)
iX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	sw_	(8,9)
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT133	20F0094-01	Sediment	06/03/20
2	LDW20-SC140	20F0094-02	Sediment	06/03/20
3	LDW20-SC142	20F0094-03	Sediment	06/03/20
4	LDW20-SC150	20F0094-04	Sediment	06/03/20
5	LDW20-SC135	20F0094-07	Sediment	06/03/20
6	LDW20-SC202	20F0094-08	Sediment	06/03/20
7	LDW20-SC203	20F0094-09	Sediment	06/03/20
8	LDW20-SC211	20F0094-10	Sediment	06/03/20
9	LDW20-SC211FD	20F0094-11	Sediment	06/03/20
10	LDW20-iT139	20F0094-13	Sediment	06/03/20
11	LDW20-IT151	20F0094-14	Sediment	06/03/20
12	LDW20-IT146	20F0094-15	Sediment	06/03/20
13				
14				

LDC #: 48680C4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2 to 9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,10,11,12	As
`	
	·
	Analysis Method
ICP	
ICP-MS	
CVAA	

LDC #: 48680C4a

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: all

							Samp	ole Identific	ation		
Analyte PB (units)	Maximum ICB/CCB (ug/L)	Action Level									
As		0.025									
,											

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
LDW20-SC109	S	Ag	41.5		75-125			2 to 9	J/UJ/A	Det
		Cu	130		75-125			2 to 9	Jdet/A	Det
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										_

Comments:

LDC#: 48680C4a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer: ATL

Method: Metals

	Concentrat	tion (mg/kg)	RPD	0 -150 - (0 0 - 1 -)
Analyte	8	9		Qualifiers (Parents Only)
Arsenic	9	8.06	11	
Cadmium	0.33	0.29	13	
Chromium	25.9	23.8	8	
Copper	46.2	40.7	13	
Lead	25.9	25.6	1	
Mercury	0.130	0.146	12	
Silver	0.32	0.29	10	
Zinc	104	93.0	11	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC156	20F0094-05	Sediment	06/03/20
LDW20-SC162	20F0094-06	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC144	20F0094-12	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133DUP	20F0094-01DUP	Sediment	06/03/20
LDW20-SC202MS	20F0094-08MS	Sediment	06/03/20
LDW20-SC202DUP	20F0094-08DUP	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concent		
Analyte	LDW20-SC211 LDW20-Sc		RPD
Total solids	53.66	54.83	2
Total organic carbon	1.79	1.84	3

X. Sample Result Verification

All sample result verifications were acceptable.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

Stage 4

SDG #: 20F0094
Laboratory: Analytical Resources, Inc.

LDC #: 48680C6

Date: 7/30/20
Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	Α	
<u>III.</u>	Calibration verification	Α	
IV	Laboratory Blanks	Α	
V	Field blanks	N	
Vi.	Matrix Spike/Matrix Spike Duplicates	Α	17, From SDG # 20F0039 (LDW20-SC109MS)
VII.	Duplicate sample analysis	Α_	16,18, From SDG # 20F0039 (LDW20-SC109DUP)
VIII.	Laboratory control samples	Α	LCS/SRM
IX.	Field duplicates	sw	(10,11)
X.	Sample result verification	Α	
Xi.	Overall assessment of data	А	

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

IB = I rip blank EB = Equipment blank SB=Source blank OTHER:

Client ID Matrix Date Lab ID LDW20-ITT133 20F0094-01 Sediment 06/03/20 LDW20-SC140 20F0094-02 Sediment 06/03/20 LDW20-SC142 20F0094-03 Sediment 06/03/20 3 LDW20-SC150 20F0094-04 Sediment 06/03/20 5 LDW20-SC156 20F0094-05 Sediment 06/03/20 6 LDW20-SC162 20F0094-06 Sediment 06/03/20 Sediment 06/03/20 20F0094-07 LDW20-SC135 8 LDW20-SC202 20F0094-08 Sediment 06/03/20 06/03/20 LDW20-SC203 20F0094-09 Sediment 20F0094-10 Sediment 06/03/20 10 LDW20-SC211 11 LDW20-SC211FD 20F0094-11 Sediment 06/03/20 06/03/20 12 LDW20-SC144 20F0094-12 Sediment Sediment 06/03/20 13 LDW20-IT139 20F0094-13 14 LDW20-IT151 20F0094-14 Sediment 06/03/20 15 20F0094-15 Sediment 06/03/20 LDW20-IT146 16 LDW20-ITT133DUP 20F0094-01DUP Sediment 06/03/20 17 LDW20-SC202MS 20F0094-08MS Sediment 06/03/20 LDW20-SC202DUP 20F0094-08DUP 06/03/20 Sediment

Reviewer: ATL

METHOD: Inorganics				
Validation Area	Yes	No	NA	Comments
I. Technical holding times			<u> </u>	
Were all technical holding times met?	Х			
II. Calibration				
Were all instruments calibrated at the				
required frequency?	Х			
Were the proper number of standards				
used?	Х			
Were all initial and continuing calibration				
verifications within the QC limits?	x		1	
Were all initial calibration correlation				
coefficients within limits as specifed by the				
method?	X		1	
Were balance checks performed as				
required?	х			
III. Blanks				
Was a method blank associated with every				
sample in this SDG?	x			
Was there contamination in the method				
blanks?		X		
Was there contamination in the initial and				
continuing calibration blanks?		х		
IV. Matrix Spike/Matrix Spike Duplicates/I	aborat	tory Du	plicates	5
Were MS/MSD recoveries within the QC				
limits? (If the sample concentration				
exceeded the spike concentration by a			1	
factor of 4, no action was taken.)	х			
Were the MS/MSD or laboratory duplicate				
relative percent differences (RPDs) within				
the QC limits?	Х			
V. Laboratory Control Samples				
Was a LCS analyzed for each batch in the				
SDG?	Х			
Were the LCS recoveries and RPDs (if				
applicable) within QC limits?	х			
X. Sample Result Verification				
Were all reporting limits adjusted to reflect				
sample dilutions?	Х			
Were all soil samples dry weight corrected?	Х			
XI. Overall Assessment of Data				·
Was the overall assessment of the data				
found to be acceptable?	Х		<u></u>	L

Page 2 of 2 Reviewer: ATL

METHOD: Inorganics							
Validation Area	Yes	No	NA	Comments			
XII. Field Duplicates							
Were field duplicates identifed in this SDG?	Х						
Were target analytes detected in the field							
duplicates?	Х						
	_						
XIII. Field Blanks							
Were field blanks identified in this SDG?		X					
Were target analytes detected in the field							
blanks?			x				

LDC #: 48680C6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 15	TS, TOC	
QC		
16	TS	
17,18	TOC	

LDC #: 48680C6

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

	Concent	ration (%)	RPD	(2
Analyte	10	11		Qualifiers (Parents Only)
Total Solids	53.66	54.83	2	
Total Organic Carbons	1.79	1.84	3	

LDC #: 48680 C6

VALIDATION FINDINGS WORKSHEET <u>Initial and Continuing Calibration Calculation Verification</u>

Page:_	1	of	
Reviewer:	1	H	_
nd Reviewer:	(

METHOD: Inorganics, I	Method _	TOC (FPA 9060A)	
The correlation coefficient	ent (r) for	the calibration of was recalculated. Calibration date:	N/A.
An initial or continuing of	calibratio	verification percent recovery (%R) was recalculated for each type of ar	nalysis using the following formula:
%R = <u>Found</u> x 100	Where,	Found = concentration of each analyte <u>measured</u> in the analysis of the ICV or CCV solu True = concentration of each analyte in the ICV or CCV source	ition

			90	90	Recalculated	Reported	Acceptable	
Type of Analysis	Analyte	Standard ID	Found (units)	True (units)	r or %R	r or %R	(Y/N)	
Initial calibration		Blank Standard 1						
		Standard 2						
	NA	Standard 3			م اید	NA	N/A	
	, ,,	Standard 4			NIA	NA	10/11	
·		Standard 5	·					
		Standard 6						
		Standard 7						
Calibration verification	70C		44.637	44.446	100	100	У	
Calibration verification	ПC		45,265	44.446	102	102	У	
Calibration verification	nc		46.913	44,446	10,6	10,6	Y	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and as	ssociated samples when reported results do not agree	within 10.0% of the
ecalculated results	•	:

VALIDATION FINDINGS CHECKLIST Quality Control Sample Recalculations

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated using the following formula:

 $%R = (Found/True) \times 100$

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

				,	Recalculated	Reported	
Sample ID	Type of Analysis	Element	Found/S	True/D	%R/RPD	%R/RPD	Acceptable (Y/N)
LCS	LCS	TOC	43.031	44.4	96.91666667	96.8	Υ
17	MS	TOC	1.8802	1.97	95.44162437	95.5	Υ
16	Duplicate	TS	72.028	72.3644	0.465952502	0.466	Υ

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids (if applicable) x Initial weight or volume)

				0 ,		Percent	Reported	Recalculated	Acceptable
Sample ID	Analyte	Raw Data (%)	Dilution	Volume (g)	(g)	solids (%)	Result (%)	Result (%)	(Y/N)
1	TS		1	6.8636	4.9668		72.36	72.3643569	Υ
2	TOC	0.543	1	0.23	0.23	66.02	0.82	0.822478037	Υ
3	TS		1	6.4035	4.6174		72.11	72.10744124	Υ
4	TOC	1.417	1	0.2248	0.2248	62.84	2.25	2.254933164	Υ
5	TS		1	6.6351	4.4181		66.59	66.58678844	Υ
6	TOC	1.161	1	0.3222	0.3222	57.19	2.03	2.030075188	Υ
7	TS		1	6.2706	3.8344		61.15	61.14885338	Υ
8	TOC	1.104	1	0.2183	0.2183	61.55	1.79	1.793663688	Υ
9	TS		1	5.6582	3.3779		59.7	59.69919762	Υ
10	TOC	0.963	1	0.2737	0.2737	53.66	1.79	1.794632874	Υ
11	TS		1	6.8484	3.7547		54.83	54.82594475	Υ
12	TOC	0.768	1	0.4534	0.4534	64.53	1.19	1.190144119	Υ
13	TS		1	6.5502	4.7143		71.97	71.97184819	Υ
14	TOC	0.445	1	0.2858	0.2858	67.22	0.66	0.662005356	Υ
15	TS		1	7.1653	5.2522		73.3	73.30048986	Υ

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT146	20F0094-15	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported at 10°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0094	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0094

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0094	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-IT146	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-IT146	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

SDG # Labora	#: 48680C21 VALIDATION #: 20F0094 atory: Analytical Resources, Inc.	S	Stage 2B		R 2nd R	Date: <u>08/07/20</u> Page: <u>1</u> of <u>1</u> eviewer: <u>JVG</u> eviewer:
The sa	amples listed below were reviewed for eartion findings worksheets.		•		•	noted in attached
	Validation Area				Comments	
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 1	I0 deg C	(Insufficient time to	cool)
II.	HRGC/HRMS Instrument performance check	Α				
III.	Initial calibration/ICV	A/A	ICAL ≤	20/35%	ICV ≤ 0	QC Limits
IV.	Continuing calibration	sw	CCV ≤ 0	QC Limits		
V.	Laboratory Blanks	sw				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N				
VIII.	Laboratory control samples	Α	OPR, S	RM		
IX.	Field duplicates	N				
X.	Labeled Compounds	Α				
XI.	Compound quantitation RL/LOQ/LODs	N	ЕМРО	= Jdets/A		
XII.	Target compound identification	N				
XIII.	System performance	N				
XIV.	Overall assessment of data	Α	<u> </u>			
Note:	N = Not provided/applicable R = Rins	o compound sate eld blank	s detected	D = Duplicate TB = Trip blan EB = Equipme		ce blank
	Client ID			Lab ID	Matrix	Date
1	.DW20-IT146			20F0094-15	Sediment	06/03/20
2						
3						
4						
5		_				
6						
7						
8						
9						
10						
lotes:						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_			 			 	 	

LDC #: 48680C21

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- Y N Y Was a routine calibration performed at the beginning of each 12 hour period?
- Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
							
	-						

LDC #: 48680C21

VALIDATION FINDINGS WORKSHEET Blanks

Page _	<u>1</u> of 1
Reviewer:_	JVG
2nd Reviewer:_	2

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

 $\frac{Y}{Y}$ Were all samples associated with a method blank?

Was a method blank performed for each matrix and whenever a sample extraction was performed?

Was the method blank contaminated?

Blank extraction date: 06/22/20 Blank analysis date: 06/25/20 Associated samples: All (>5X) Conc. units: ng/Kg

Compound	Blank ID		Sample Identification							
	BIF0465-BLK1	(5x)								
В	0.175	0.88								
М	0.0946*	0.47								
0	0.166	0.83								
Q	0.521*	2.61								
G	1.32	6.60								
S	0.175	0.88								
Y	0.166	0.83								

*EMPC

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC159	20F0105-01	Sediment	06/04/20
LDW20-SC154	20F0105-02	Sediment	06/04/20
LDW20-SC158	20F0105-03	Sediment	06/04/20
LDW20-IT243	20F0105-04	Sediment	06/04/20
LDW20-SC159MS	20F0105-01MS	Sediment	06/04/20
LDW20-SC159MSD	20F0105-01MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0105	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC159MS/MSD (LDW20-SC159)	Aroclor-1260	48.0 (58-120)	51.1 (58-120)	J (all detects)	А

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-IT243	Arodor-1248	43.5	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, MS/MSD %R, and RPD between two columns, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0105

Sample	Compound	Flag	A or P	Reason
LDW20-SC159 LDW20-SC154 LDW20-SC158 LDW20-IT243	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	А	Initial calibration verification (%D)
LDW20-SC159	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT243	Aroclor-1248	J (all detects)	А	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

SDG	#: 48680D3b VALIDAT #: 20F0105 ratory: Analytical Resources, Inc.		TENESS WORKSHEET ge 2B	Date: 08/04 p Page: _of Reviewer: _0/4
	HOD: GC Polychlorinated Biphenyls (E	PA SW846 Meth	od 8082A)	Reviewer: A
	samples listed below were reviewed for ation findings worksheets.	each of the follow	wing validation areas. Validatior	n findings are noted in attached
	Validation Area	 	Comme	ents
l.	Sample receipt/Technical holding times	AA		
H.	Initial calibration/ICV	AISW	10AL = 20%	101 202
H. III.	Initial calibration/ICV Continuing calibration	A / SW	10AL E 20%	101 202
		A / ŚW		101 202
111.	Continuing calibration	A / ŚW		101 L 20 3
III.	Continuing calibration Laboratory Blanks	A / SW A A N A /A		101 703
III. IV. V.	Continuing calibration Laboratory Blanks Field blanks	AAA		101 202

Overall assessment of data ND = No compounds detected D = Duplicate SB=Source blank A = Acceptable Note: N = Not provided/applicable SW = See worksheet R = Rinsate TB = Trip blank OTHER: FB = Field blank EB = Equipment blank

SM

	Client ID	Lab ID	Matrix	Date
1_	LDW20-SC159	20F0105-01	Sediment	06/04/20
2	LDW20-SC154	20F0105-02	Sediment	06/04/20
3	LDW20-SC158	20F0105-03	Sediment	06/04/20
4	LDW20-IT243	20F0105-04	Sediment	06/04/20
5	LDW20-SC159MS	20F0105-01MS	Sediment	06/04/20
6	LDW20-SC159MSD	20F0105-01MSD	Sediment	06/04/20
7				
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12				

Notes: BI F0376-BLK1

chromatographic interference. (MRS) Note: # 4 = DCB not reported due to

VIII. Laboratory control samples

Compound quantitation/RL/LOQ/LODs

Target compound identification

Field duplicates

IX.

Χ. XI.

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	xx.

Notes:			
,		 	

LDC #: 48680 D3b

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

2nd Reviewer

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? // %D or // %R

Was an initial calibration verification standard analyzed after each ICAI Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y(N)N/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/	Commound	%D (Limit ≤ 20.0)	Acceptated Committee	0
		Standard ID	Column	Compound	(Littilt ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SI F0176-Sc1	11 2c	BB	21.0	All (Det)	3/45/A
							(qual Z AA BB)
<u> </u>							
 							
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48680 D26 LDC #:

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

	Page:_	1	_of	1
	Reviewer:_		JVG	_
2nd	Reviewer:_	(

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y/N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

N/A Was a MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed? Y(N) N/A

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

ſΫ́			MS	MSD			
#	MS/MSD ID	Compound	%R (Limits)	%R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	5/4	BB	48.0 (58-120)	51.1 (58-120)	()	(Det)	J/W/A
			()	()	()		
		.	()	()	()		
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LDC #: 48680 D3b

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	7-ot_7
Reviewer: _	JVA
2nd Reviewer:	4

METHOD: __ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (< 40%)	Qualifications
	Z	4	43,5	J dets /A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Arsenic

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT243	20F0105-04	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Arsenic - Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D4a VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0105 Stage 2B Page: 1 of 1 Reviewer: ATL 2nd Reviewer: 48680D4a Date: 7/30/20 Page: 1 of 1 Reviewer: ATL 2nd Reviewer: 48680D4a

METHOD: Arsenic (EPA SW 846 Method 6020A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
III.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	Α	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	Α	From SDG # 20F0109 (LDW20-SC214MS/MSD)
VIII.	Duplicate sample analysis	Α	From SDG # 20F0109 (LDW20-SC214DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N_	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:

SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT243	20F0105-04	Sediment	06/04/20
2				
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13				
Note	S:			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC159	20F0105-01	Sediment	06/04/20
LDW20-SC154	20F0105-02	Sediment	06/04/20
LDW20-SC158	20F0105-03	Sediment	06/04/20
LDW20-IT243	20F0105-04	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D6 VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0105 Laboratory: Analytical Resources, Inc. Stage 2B

Date: 7/30/20
Page: 1 of 1
Reviewer: A71
2nd Reviewer: //

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	l	1	
	Validation Area	<u> </u>	Comments
1.	Sample receipt/Technical holding times	A/A	
- 11	Initial calibration	A	
<u>III.</u>	Calibration verification	A	
IV	Laboratory Blanks	Α	
v	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	From SDG # 20F0094 (LDW20-SC202MS)
VII.	Duplicate sample analysis	A	From SDG # 20F0094 (LDW20-ITT133DUP), (LDW20-SC202DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	А	

Note:

A = Acceptable
N = Not provided/applicable
SW = See worksheet

R = Rinsate

ND = No compounds detected

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC159	20F0105-01	Sediment	06/04/20
2	LDW20-SC154	20F0105-02	Sediment	06/04/20
3	LDW20-SC158	20F0105-03	Sediment	06/04/20
4	LDW20-IT243	20F0105-04	Sediment	06/04/20
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LDC #: 48680D6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 4	TS, TOC

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT243	20F0105-04	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0105	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0105

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0105	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0105

Sample	Compound	Flag	A or P	Reason
LDW20-IT243	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-IT243	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

SDG#	:48680D21VALIDATIOI :20F0105 atory:_Analytical Resources, Inc.		PLETENESS tage 2B	S WORKSHEET		Date: <u>08/07/20</u> Page: <u>1</u> of <u>1</u> viewer: <u>JVa</u>
The sa	OD: HRGC/HRMS Polychlorinated Dioxinamples listed below were reviewed for eaction findings worksheets.		·	·		
	Validation Area			Comm	ents	
1.	Sample receipt/Technical holding times	A/A				
II.	HRGC/HRMS Instrument performance check	А				
III.	Initial calibration/ICV	A/A	ICAL ≤ 2	20/35%	ICV ≤ Q	C_Limits
IV.	Continuing calibration	sw	CCV ≤ 0	QC Limits		
V.	Laboratory Blanks	sw				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N				
VIII.	Laboratory control samples	А	OPR,	SRM		
IX.	Field duplicates	N				
Х	Labeled Compounds	Α				
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC	= Jdets/A		
XII.	Target compound identification	N				
XIII.	System performance	N				
XIV.	Overall assessment of data	Α		· · · · · · · · · · · · · · · · · · ·		
Note:	N = Not provided/applicable R = Rins	o compounds sate eld blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Source OTHER: k	e blank
	Client ID			Lab ID	Matrix	Date
1 L	.DW20-IT243			20F0105-04	Sediment	06/04/20
2	5425 11246			201010001	Countrient	00/04/20
3						
4						
5						
6			-			
7						
8						
9						
10						
Notes:						
В	F0465-BLK1] [

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:				

LDC #: 48680D21

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page: 1 of 1

Reviewer:__JXG 2nd Reviewer: (

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- <u>Y</u> <u>N</u> <u>Y</u>
- Was a routine calibration performed at the beginning of each 12 hour period?
 Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
							
<u> </u>							
				<u> </u>		L	

LDC #: 48680D21

VALIDATION FINDINGS WORKSHEET Blanks

	Page ₋	_1_of_1_
	Reviewer:	_JVG
2nd	Reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

<u>Y</u> <u>Y</u> <u>Y</u> Were all samples associated with a method blank?

Was a method blank performed for each matrix and whenever a sample extraction was performed?

Was the method blank contaminated?

Blank extraction date: 06/22/20 Blank analysis date: 06/25/20 Associated samples:___ All (>5X) Conc. units: na/Ka

Control united high										
Compound	Blank ID			Sample Identification						
	BIF0465-BLK1	(5x)					3.00			
В	0.175	0.88								
М	0.0946*	0.47								
0	0.166	0.83								
Q	0.521*	2.61								
G	1.32	6.60								
s	0.175	0.88								
Y	0.166	0.83								

*EMPC

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680E2a

SDG #: 20F0109 Laboratory: Analytical Resources, Inc. Stage 2B

Reviewer: 2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments Insufficient
I.	Sample receipt/Technical holding times	SALA	Cooler temp. = 13.8°C, 12.4°C, 10.1°C, 11.2°C time to
II.	GC/MS Instrument performance check	A'	
111.	Initial calibration/ICV	AIA	ICAL = 20% r (0/=30%
IV.	Continuing calibration	\ A	CW & 202
V.	Laboratory Blanks	A	
VI.	Field blanks		
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank

OTHER:

Client ID	Lab ID	Matrix	Date
DW20-SC214	20F0109-05	Sediment	06/04/20
DW20-SC251	20F0109-09	Sediment	06/04/20
DW20-SC264	20F0109-10	Sediment	06/04/20
DW20-SC251MS	20F0109-09MS	Sediment	06/04/20
DW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20
		L	
	_DW20-SC214 _DW20-SC251 _DW20-SC264 _DW20-SC251MS _DW20-SC251MSD	DW20-SC214 20F0109-05 DW20-SC251 20F0109-09 DW20-SC264 20F0109-10 DW20-SC251MS 20F0109-09MS	DW20-SC214 20F0109-05 Sediment DW20-SC251 20F0109-09 Sediment DW20-SC264 20F0109-10 Sediment DW20-SC251MS 20F0109-09MS Sediment

BIFOGIO-BIKI	 _	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0109	J (all detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	Benzoic acid	22.9	All samples in SDG 20F0109	J (all detects)	А

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0410-BLK2	06/17/20	1,4-Dichlorobenzene Benzoic acid	0.7 ug/Kg 17.1 ug/Kg	All samples in SDG 20F0109

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SC214	1,4-Dichlorobenzene	2.5 ug/Kg	2.5U ug/Kg
LDW20-SC251	1,4-Dichlorobenzene Benzoic acid	2.1 ug/Kg 89.0 ug/Kg	2.1U ug/Kg 89.0U ug/Kg
LDW20-SC264	1,4-Dichlorobenzene	2.9 ug/Kg	2.9U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and continuing calibration %D, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC214 LDW20-SC251 LDW20-SC264	Benzoic acid	J (all detects)	А	Continuing calibration (%D)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC214	1,4-Dichlorobenzene	2.5U ug/Kg	А
LDW20-SC251	1,4-Dichlorobenzene Benzoic acid	2.1U ug/Kg 89.0U ug/Kg	А
LDW20-SC264	1,4-Dichlorobenzene	2.9U ug/Kg	А

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

SDG a Labor METH The sa	#:48680E2bVALIDAT #:20F0109 atory: Analytical Resources, Inc. SVOA HOD: GC/MS Polynuclear Aromatic Hy amples listed below were reviewed for tion findings worksheets.	Si ydrocarbo ns (E		F 2nd F SIM)	Date: 08/04/ Page: 1 of 1 Reviewer: 246 Reviewer: 256 Reviewer: 256
	Validation Area		Co	mments	Insufficient
i.	Sample receipt/Technical holding times	SAI/A	Cooler temps = 13.8°C, 1		.2°0
11.	GC/MS Instrument performance check	A			
111.	Initial calibration/ICV	AISH	1CAL = 20%	r la	C 30/
IV.	Continuing calibration	SIN	CON = 20 %		
V.	Laboratory Blanks	ŚŴ			
VI.	Field blanks				
VII.	Surrogate spikes	À			
VIII.	Matrix spike/Matrix spike duplicates	Å			
IX.	Laboratory control samples	A	LCS SRM		
X.	Field duplicates	N			
XI.	Internal standards	À			
XII.	Compound quantitation RL/LOQ/LODs	N			
XIII.	Target compound identification	N			
XIV.	System performance	N			
XV.	Overall assessment of data	A			
Note:	N = Not provided/applicable R =	= No compounds Rinsate = Field blank	detected D = Duplicate TB = Trip blank EB = Equipment	SB=Sour OTHER: blank	ce blank
	Client ID		Lab ID	Matrix	Date
1	LDW20-SC214		20F0109-05	Sediment	06/04/20
2	LDW20-SC251		20F0109-09	Sediment	06/04/20
	LDW20-SC264		20F0109-10	Sediment	06/04/20

20F0109-09MS

20F0109-09MSD

Sediment

Sediment

06/04/20 06/04/20

BIF 0410- BLK2

LDW20-SC251MS

LDW20-SC251MSD

8

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethỳlamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCÇ. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene.	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #:	48680	E 26
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VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>\</u> _of	1
Reviewer:	JУG	
2nd Reviewer:		

METHOD: GC/MS-PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

YN N/A Were all %D within the validation criteria of ≤20/30% %D?

#	Date	Standard ID	Compound	Finding %D (Limit: < 20.0% (30%)	Associated Samples	Qualifications
		SI F0395- SCV L	QQ	65.7	All (Det)	J/uJ/A
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LDC #: 48680 E26

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page: ___of____ Reviewer: ___JVG 2nd Reviewer: ____

SUZA-METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y(N)N/A

Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/26/20	NT1420626155	PPP	22,9		All (Det)	J/NJ/A
						7111 (11)	5/NS/A
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LDC#: 480	680 E	26
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VALIDATION FINDINGS WORKSHEET Blanks

Page:_	<u> </u>	1
Reviewer:	JVG	
nd Reviewer		

Acro 5		E
METHOD: GC/MS -PAĤ Ì(EPA SW 846 Method	8270D-SIM

Sim

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y\N N/A Was a method blank analyzed for each matrix?

Was a method blank analyzed for each concentration preparation level? Y N N/A

Was a method blank associated with every sample? Y/N N/A

Was the blank contaminated? If yes, please see qualification below. Y/N N/A

Blank extraction date: 06/17/20 Blank analysis date: 06/26/20 Conc. units: W /kg Associated Samples:

Compound	Blank ID						
	BIF0410-B	UK2	1	2	3		
E	0.7		2.5/U	2.1/4	2.9 /u		
PPP	17.1			89.0/U			
				,			

AII

Blank analysis date: Blank extraction date:

Associated Samples: Conc. units:

Compound	Blank ID					
·		,				·

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0109	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to no ICV performed, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	Hexachlorobenzene	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

SDG #	t: 48680E3a VALIDATIO t: 20F0109 atory: Analytical Resources, Inc.		LETENE : tage 2B	SS WORKSH		Date: 08/04/ Page: \ of \ \ Reviewer: \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
METH	OD: GC Hexachlorobenzene (EPA SW8	46 Method	8081B)			
	amples listed below were reviewed for ea ion findings worksheets.	ch of the fo	ollowing vali	dation areas. Va	lidation findings a	re noted in attached
	Validation Area			C	omments	
1.	Sample receipt/Technical holding times	SW A	coole	r temps =	13.800 11.20	c Insuffici
II.	GC Instrument Performance Check	N			7	time to
III.	Initial calibration/ICV	A /SW	10	AL = 203		1WE 20 %
IV.	Continuing calibration	A	00	4L = 20% V = 206		
V.	Laboratory Blanks	1 6				
VI.	Field blanks		*	All sym		
VII.	Surrogate spikes //5	A /A	-			
VIII.	Matrix spike/Matrix spike duplicates	N				
IX.	Laboratory control samples	Δ		Les		
X.	Field duplicates					
XI.	Compound quantitation/RL/LOQ/LODs	N				
XII.	Target compound identification	N				
XIII.	System Performance	N			-	
XIV	Overall assessment of data	1				
lote:	A = Acceptable ND = N N = Not provided/applicable R = Rin	o compounds sate eld blank	detected	D = Duplicate TB = Trip blan EB = Equipme	C OTHE	ource blank R:
	Client ID			Lab ID	Matrix	Date
1- 1	_DW20-SC214			20F0109-05	Sediment	06/04/20
			117	20F0109-09	Sediment	06/04/20
	DW20-SC264			20F0109-10	Sediment	06/04/20
4				· ·		
5						
6		· · · · · · · · · · · · · · · · · · ·				
7				1		
8		-				
9						
10				1		
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	BI F0353- BLKO					

LDC #: 48680E3a

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_1	<u> </u>
Reviewer:	JVG
2nd Reviewer:_	Q

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? ___%D or ___%R

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 11, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC168	20F0109-01	Sediment	06/04/20
LDW20-SC161	20F0109-02	Sediment	06/04/20
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC167	20F0109-04	Sediment	06/04/20
LDW20-SC167DL	20F0109-04DL	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC318	20F0109-08	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC168MS	20F0109-01MS	Sediment	06/04/20
LDW20-SC168MSD	20F0109-01MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0109	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC168	Aroclor-1260	44.5	J (all detects)	А
LDW20-SC161	Aroclor-1248	44.8	J (all detects)	Α
LDW20-SC167	Aroclor-1248	42.1	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SC167	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SC167DL	All compounds except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D and RPD between two columns, data were qualified as estimated in nine samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC168 LDW20-SC161 LDW20-IT236 LDW20-SC214 LDW20-IT232 LDW20-SC318 LDW20-SC251 LDW20-SC251 LDW20-SC264	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC167	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	Α	Initial calibration verification (%D)
LDW20-SC167DL	Aroclor-1260	J (all detects)	Α	Initial calibration verification (%D)
LDW20-SC168	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC161 LDW20-SC167	Aroclor-1248	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC167	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-SC167DL	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680E3b

SDG #: 20F0109 Laboratory: Analytical Resources, Inc. Stage 2B

2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments (Insufficient
1.	Sample receipt/Technical holding times	SW/A	Cooper temps = 13.8°C 12.4°C 10.1°C 11.2°C
II.	Initial calibration/ICV	A ISW	1CAL 620% 1CV 6 20% CCV 6 20%
111.	Continuing calibration	ΙA	CW 6 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	Ü	
VI.	Surrogate spikes /(S	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS D SRM
IX.	Field duplicates	N	,
X.	Compound quantitation/RL/LOQ/LODs	SM	
XI.	Target compound identification	N,	
XII_	Overall assessment of data	SW	

A = Acceptable Note:

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC168	20F0109-01	Sediment	06/04/20
2	LDW20-SC161	20F0109-02	Sediment	06/04/20
3	LDW20-IT236	20F0109-03	Sediment	06/04/20
4	LDW20-SC167	20F0109-04	Sediment	06/04/20
5	LDW20-SC167RE DL	20F0109-04RE DL	Sediment	06/04/20
6	LDW20-SC214	20F0109-05	Sediment	06/04/20
7	LDW20-IT232	20F0109-07	Sediment	06/04/20
8	LDW20-SC318	20F0109-08	Sediment	06/04/20
9	LDW20-SC251	20F0109-09	Sediment	06/04/20
10	LDW20-SC264	20F0109-10	Sediment	06/04/20
11	LDW20-SC168MS	20F0109-01MS	Sediment	06/04/20
12	LDW20-SC168MSD	20F0109-01MSD	Sediment	06/04/20
13		-06		

Note	s:	 		
_	BIF0345-BUX1			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	xx.

Notes:		

LDC #: 48680 E36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>L</u> o	f
Reviewer:_	J١	/G
2nd Reviewer:		

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Was an initial calibration verification standard analyzed after each ICAL for each instrument? Y(N)N/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID SIF0176-SC	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SI F0176- SC	11 20	BB	21.0	An (Det)	5/45/A
							J/WJ/A (qual Z, AA, BB)
				. (3/3			
<u></u>							
<u></u>							
<u></u>							
		A.V					

LDC #: 48680 E36

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: _	of	1
Reviewer: _	JVG	
2nd Reviewer:	4	7

 $\begin{tabular}{ll} {\tt METHOD:} & $\not _ {\tt GC} \begin{tabular}{ll} {\tt HPLC} \\ \end{tabular}$

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

X/N N/A Y N N/A

N/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

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J

Comments: See sample calculation verification worksheet for recalculations

LDC#: 48680 E36

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page:	_of\
Reviewer:	JVG
nd Reviewer:	

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

YN N/A Was the overall quality and usability of the data acceptable?

1			T The state of the	
#	Compound Name	Finding	Associated sample	Qualifications
	BB	> cal range	4	NR /A
	All except BB	di)	5	У

			/	

Comments:	s:	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
		IVIAUIX	
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC214MS	20F0109-05MS	Sediment	06/04/20
LDW20-SC214MSD	20F0109-05MSD	Sediment	06/04/20
LDW20-SC214DUP	20F0109-05DUP	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Arsenic	0.025 ug/L	LDW20-SC214

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC214MS/MSD (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Silver	29.7 (75-125)	44 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC214MS/MSD (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Silver	37.8 (≤20)	J (all detects)	А

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW20-SC214DUP (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Mercury	-	0.189 mg/Kg (≤0.0974)	J (all detects)	Α

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD and DUP difference, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0109

Sample	Analyte	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	Silver	J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)(RPD)
LDW20-SC214 LDW20-SC251 LDW20-SC264	Mercury	J (all detects)	А	Duplicate sample analysis (difference)

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0109

LDC #: 48680E4a

Stage 2B

Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

Date: 7/30/20

Laboratory: Analytical Resources, Inc.

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
III.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	N_	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	(6,7)
VIII.	Duplicate sample analysis	sw	8
IX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Matrix Date Client ID Lab ID LDW20-IT236 20F0109-03 Sediment 06/04/20 2 LDW20-SC214 20F0109-05 Sediment 06/04/20 20F0109-07 Sediment 06/04/20 3 LDW20-IT232 LDW20-SC251 20F0109-09 Sediment 06/04/20 5 LDW20-SC264 20F0109-10 Sediment 06/04/20 20F0109-05MS Sediment 06/04/20 LDW20-SC214MS 6 LDW20-SC214MSD 20F0109-05MSD Sediment 06/04/20 LDW20-SC214DUP 20F0109-05DUP Sediment 06/04/20 8 9 10 11 12

Notes:	 	
	 ,	

LDC #: 48680E4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2,4,5	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,3	As
QC	
6,7,8	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
	Analysis Method
ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 2

	Sample Identificatio						ation			
Analyte	PB (units)	Maximum ICB/CCB (ug/L)	Action Level							
As		0.025								
		-								

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
6 & 7	S	Ag	29.7		75-125			2,4,5	J/UJ/A	Det PS=96.6%
		Ag				37.8	20	2,4,5	J/UJ/A	Det
							İ			

Comments:

VALIDATION FINDINGS WORKSHEETS <u>Laboratory Duplicates</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Laboratory duplicate analysis was performed by the laboratory. All laboratory duplicates were with the relative percent difference (RPD) for samples >5X the reporting limits with the exceptions listed below. If samples were <5X the reporting limits, the difference was within 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (mg/kg)	Difference Limit	Associated Samples	Qualification	Det/ND
	3 S	Hg			0.189	0.0974	2,4,5	J/UJ/A	Det
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Comments:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC168	20F0109-01	Sediment	06/04/20
LDW20-SC161	20F0109-02	Sediment	06/04/20
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC167	20F0109-04	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC169	20F0109-06	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC318	20F0109-08	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC168DUP	20F0109-01DUP	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251DUP	20F0109-09DUP	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680E6 Date: 7/30/20 Stage 2B SDG #: 20F0109 Page: 1 of 1 Laboratory: Analytical Resources, Inc. Reviewer:_ 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	Α	
III.	Calibration verification	Α	
IV	Laboratory Blanks	Α	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	Α	11, From SDG # 20F0094 (LDW20-SC202MS)
VII.	Duplicate sample analysis	Α	10,12, From SDG # 20F0094 (LDW20-SC202DUP)
VIII.	Laboratory control samples	Α	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	Α	

Note: A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

				T
	Client ID	Lab ID	Matrix	Date
1	LDW20-SC168	20F0109-01	Sediment	06/04/20
2	LDW20-SC161	20F0109-02	Sediment	06/04/20
3	LDW20-IT236	20F0109-03	Sediment	06/04/20
4	LDW20-SC167	20F0109-04	Sediment	06/04/20
5	LDW20-SC214	20F0109-05	Sediment	06/04/20
6	LDW20-IT232	20F0109-07	Sediment	06/04/20
7	LDW20-SC318	20F0109-08	Sediment	06/04/20
8	LDW20-SC251	20F0109-09	Sediment	06/04/20
9	LDW20-SC264	20F0109-10	Sediment	06/04/20
10	LDW20-SC168DUP	20F0109-01DUP	Sediment	06/04/20
11	LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
12	LDW20-SC251DUP	20F0109-09DUP	Sediment	06/04/20

Notes:	 		

LDC #: 48680E6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 9	TS, TOC
-	
QC	
10	TS
11,12	тос

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC148CDL	20F0157-01DL	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC148CMS/MSD (LDW20-SC148C)	Phenanthrene	415 (49-120)	-80.1 (49-120)	J (all detects)	А
LDW20-SC148CMS/MSD (LDW20-SC148C)	Benzo(a)anthracene Chrysene	-	-0.974 (49-120) -159 (47-120)	J (all detects) J (all detects)	Α
LDW20-SC148CMS/MSD (LDW20-SC148C)	Benzofluoranthenes, total	-	23.5 (30-160)	J (all detects)	А

For LDW20-SC148CMS/MSD, no data were qualified for fluoranthene and pyrene percent recoveries (%R) and relative percent differences (RPD) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC148CMS/MSD (LDW20-SC148C)	Phenanthrene Benzo(a)anthracene Chrysene	133 (≤30) 48.8 (≤30) 71.1 (≤30)	J (all detects) J (all detects) J (all detects)	А

IX. Laboratory Control Samples/ Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0512-SRM1	Anthracene	53.0 (57-143)	All samples in SDG 20F0157	J (all detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-SC148C	Fluoranthene Pyrene	Results exceeded calibration range.	Not reportable	А
LDW20-SC148CDL	All compounds except Fluoranthene Pyrene	Results from undiluted analyses were more usable.	Not reportable	А

Due to MS/MSD %R and RPD and SRM %R, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C	Phenanthrene	J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Benzo(a)anthracene Chrysene	J (all detects) J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Benzofluoranthenes, total	J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Phenanthrene Benzo(a)anthracene Chrysene	J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Anthracene	J (all detects)	Р	Standard reference materials (%R)
LDW20-SC148C	Fluoranthene Pyrene	Not reportable	А	Overall assessment of data
LDW20-SC148CDL	All compounds except Fluoranthene Pyrene	Not reportable	А	Overall assessment of data

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

SDG #	#: 48680F2a VALIDATIO #: 20F0157 atory: Analytical Resources, Inc.		LET tage			WORKSH	IEET		Date: 08/05/7 Page:of eviewer:04/
METH	IOD: GC/MS Semivolatiles (EPA SW 846	Method 82	70E)					Ziid Ne	viewei.
	amples listed below were reviewed for ea tion findings worksheets.	ch of the fo	ollowi	ng v	/alidat	ion areas. Va	alidation	findings are no	oted in attached
	Validation Area						Commer	nts	
I	Sample receipt/Technical holding times	AIA							
II.	GC/MS Instrument performance check	A							
111.	Initial calibration/ICV	AIA			ICAL	= 203		IME	368
IV.	Continuing calibration	A			CW	5 20%			
V.	Laboratory Blanks	À							
VI.	Field blanks	12							
VII.	Surrogate spikes	A							
VIII.	Matrix spike/Matrix spike duplicates	SW							
IX.	Laboratory control samples	SW			W	S SR	M		
X.	Field duplicates	N							
XI.	Internal standards	A							
XII.	Compound quantitation RL/LOQ/LODs	N.							
XIII.	Target compound identification	N	4						
XIV.	System performance	N							
XV.	Overall assessment of data	SW							
ote:	N = Not provided/applicable R = Rins	o compounds sate eld blank	detecte	ed D	= Dupl	icate TB = Trip blan EB = Equipme	k	Source blank OTHER:	
1	Client ID					Lab ID		Matrix	Date
ı	_DW20-SC148C					20F0157-01		Sediment	06/08/20
2 1	DW20-SC148CRE DL					20F0157-01 RE	0L	Sediment	06/08/20
ı	_DW20-SC155B					20F0157-02		Sediment	06/08/20
	_DW20-SC166C					20F0157-03		Sediment	06/08/20
5 L	_DW20-SC208B					20F0157-04		Sediment	06/08/20
j [_DW20-SC148CMS					20F0157-01MS		Sediment	06/08/20
, I	LDW20-SC148CMSD				20F0157-01 M SI	o	Sediment	06/08/20	
3 [LDW20-SC148CDUP				20F0157-01DUI	-	Sediment	06/08/20	
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VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzof worantheres, Total

LDC #:	48680	Fla

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:		of	
Reviewer:_	JV	G	
2nd Reviewer:			_
		_	

METHOD: GC/MS BNA (EPA SW 846 Method 8270¢)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an

associated MS/MSD. Soil / Water.

M N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		6/7	uu	415 (49-126)	-80.1 (49-120)	()	(Det)	J dets /A
		,,	74	347 (53-120)		()	1	NQ Y
			22	172 (48-121)	-546 (48-121)	()		
			cec		-0,974 (49-120)	()	(Pet)	J/R/A
			סממ	()	-159 (47-120)	()		
			AZ	()	23.5 (30-)60)	()		J/UJ/A
	,		uu	()	()	133 (30)		J dets A
			14	()	()	139 ()		NO +
			ZZ	()_	()	45,4 ()		
			ca	()	()	48.8 ()	(Det)	J dets/A
			DDD	()	()	71.1 ()		
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LDC #: 48680 F2a

Page: ___of__/
Reviewer: __JVG
2nd Reviewer: ___

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIFUSIZ-SRMI	<u>- 77</u>	53.0 (57-143	()	(,)	All (Pet)	J/UJ/P
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VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: _	<u> </u> of_)
Reviewer:	ØV,G
nd Reviewer:	

METHOD: GC/MS BNA (EPA SW 846 Method 82700)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

YN N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		1	77 22	7 cal range	MR/A
			· '		
		2	All except above	/ dil	
		<u> </u>			
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				-	
<u> </u>					

Comments:				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	All samples in SDG 20F0157	J (all detects) UJ (all non-detects)	Α

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/22/20	Benzoic acid	25.1	All samples in SDG 20F0157	J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0512-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene	33.9 (34-166) 33.6 (36-164)	All samples in SDG 20F0039	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Benzoic acid	J (all detects)	А	Continuing calibration (%D)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	1,4-Dichlorobenzene 1,2-Dichlorobenzene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC#	#: <u>48680F2b</u> VAL I	IDATION CO	ОМР	LETENESS	WOF	RKSHEET		Date: 08/05/
SDG #	#: <u>20F0157</u>		S	Stage 2B			P	Page:_ <u> </u> _of[
Labora	atory: Analytical Resources, Inc.	_					Revi	iewer: <u>ૠ</u> ᠘
•≉⊏T∐	Sv7 H OD : GC/MS Po lynuclear Aroma	A Liverages	-no (I	CD4 6/4/ 8/6 F	4nthod	0070E CIM)	2nd Revi	ewer: U
METr	IOD: GC/IVIS PO lynacic al Aloina	ATIC HYGIOCAIDO	∌ns (∟	EPA SVV 040 IV	/letnou	8270 ⊏- ⊙11v1 <i>j</i>		
	amples listed below were review tion findings worksheets.	ed for each of	the fo	ollowing validat	tion are	as. Validation	findings are note	∍d in attached
	Validation Area					Commer	nts	
I.	Sample receipt/Technical holding time	es A	1 A				·	
II.	GC/MS Instrument performance chec		\overline{A}_{-}'					
III.	Initial calibration/ICV		/SW	ICAI	レニス	20%	12 1WE	30 h
IV.	Continuing calibration		, KK			20%		
V.	Laboratory Blanks		A					
VI.	Field blanks	!	L					
VII.	Surrogate spikes		Â					
VIII.	Matrix spike/Matrix spike duplicates		A					
IX.	Laboratory control samples	5	SW	LC	<u>s</u>	SRM		
X	Field duplicates		N					
XI.	Internal standards		A			···		
XII.	Compound quantitation RL/LOQ/LOD)s	N_					
XIII.	Target compound identification		N		·			
XIV.	System performance		N					-
XV.	Overall assessment of data		<u>A</u>			211		
Note:	A = Acceptable N = Not provided/applicable SW = See worksheet	ND = No comp R = Rinsate FB = Field bla		s detected	TB = T	uplicate Trip blank Equipment blank	SB=Source bi OTHER:	lank
	Client ID						Matrix	Date
1 L	LDW20-SC148C					57-01	Sediment	06/08/20
2 L	LDW20-SC155B					57-02	Sediment	06/08/20
3 Ι	LDW20-SC166C				20F015	7-03	Sediment	06/08/20
4 L	LDW20-SC208B				20F015	7-04	Sediment	06/08/20
5 L	LDW20-SC148CMS				20F015	57-01MS	Sediment	06/08/20
6 L	LDW20-SC148CMSD	20F015	7-01MSD	Sediment	06/08/20			

Notes	lotes:							
_	BIF 0512-BULZ							

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF, Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene.	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48650 F26

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of
Reviewer:_	J <u>V</u> G
2nd Reviewer:_	4

METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was an initial calibration verification standard analyzed after each ICAL for each instrument? N N/A

Were all %D within the validation criteria of ≤20/30% %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <2 20: 0%(30%)	Associated Samples	Qualifications
	02/28/20	SIC0029-SCVI	QQ	34.4	All (ND +Det)	J/UJ/A
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LDC #: 48 680 F26

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:	of_
Reviewer:	JVG
2nd Reviewer:	0_

METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Y (N)N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument? Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#_	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/22/20	NT10200622035	PPP	25.)		All (Det)	J/uJ/A
						1 11	J/W37 A
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							·
					·		
						· ·	

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS) /CRM

Reviewer: 2nd Reviewer:

P SVVA METHOD: GC/MS PAFT (EPA SW 846 Method 8270) -SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a LCS required?

Y N N/A Y N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

# #	LCS/LCSD ID	Compound		CS Limits)	LCSD %R (Limits)		RPD (Limits)			ted Samples	Qualifications
	BIF0512-SRM2	E F	33.9	(34-166	()	()	411	(ND + Det)	J/WJ/P
		F		(36-164	()	()			
				()	()	()			
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 18, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0496-BLK1	06/19/20	Hexachlorobenzene	0.18 ug/Kg	All samples in SDG 20F0157

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

SDG abor METH The sa	#: 20F0157 ratory: Analytical Resources, Inc. HOD: GC Hexachlorobenzene (EPA SW8 amples listed below were reviewed for ea	Sta 346 Method 8	age 2B 8081B)	SS WORKSHEET	2nd R	Date: 08/06 Page: _of_ eviewer: _QV eviewer: _QV eviewer: _QV
/alida	tion findings worksheets. Validation Area	ents				
l.	Sample receipt/Technical holding times	TA/AL				
11.	GC Instrument Performance Check	1 4				
JII.	Initial calibration/ICV	AIA	10	AL = 20 %	10	V= 203
iV.	Continuing calibration	A		W = 30 h		<u> </u>
V.	Laboratory Blanks	SW				
VI.	Field blanks	II.				
VII.	Surrogate spikes /15	A/A				
VIII.	Matrix spike/Matrix spike duplicates	A				
IX.	Laboratory control samples	A		LCS		
X.	Field duplicates	N				
XI.	Compound quantitation/RL/LOQ/LODs	N				
XII.	Target compound identification	N				
XIII.	System Performance	N				
XIV	Overall assessment of data	A				
Note:	N = Not provided/applicable R = Rin	No compounds onsate Field blank	detected	D = Duplicate TB = Trip blank EB = Equipment blar	SB=Sourc OTHER: ık	e blank
	Client ID			Lab ID	Matrix	Date
1	LDW20-SC148C			20F0157-01	Sediment	06/08/20
-	LDW20-SC155B			20F0157-02	Sediment	06/08/20
_	LDW20-SC166C			20F0157-03	Sediment	06/08/20
_	LDW20-SC208B			20F0157-04	Sediment	06/08/20
5	LDW20-SC148CMS			20F0157-01MS	Sediment	06/08/20
	LDW20-SC148CMSD			20F0157-01MSD	Sediment	06/08/20
7						
8						
9						
10						
lotes:						
	BIF0496- BLL1					
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VALIDATION FINDINGS WORKSHEET Blanks

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Reviewer:	ʻJVĢ
2nd Reviewer	<u> </u>
	_

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

WETHOD. GC Pesticides/P	OD3 (LI A 000 04	o Method ood	170002)						
Y N N/A Was a met Y N N/A If extract cl	amples associated the containing the	l with a metho ned for each m rmed, were ex the method bla	d blank? natrix and who tract clean-up anks? If ves. r	enever a sam o blanks analy olease see the	ple extraction zed at the pr	was perform oper frequenc s below.	cies?	ND)	
Compound	Blank ID				San	nple Identificati	on		
7/3000	BI # 0496	-BUL1							
Hexachloro benze									
				-					
Blank extraction date: Conc. units:	Blank analysis	date:		Ass	ociated sample	s:			
Compound	Blank ID				San	nple Identificati	on		

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: All contaminants within five times the method blank concentration were qualified as not detected, "U".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0157	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC148C	Aroclor-1260	40.1	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and RPD between two columns, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC148C	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

l DC	#: 48680F3b VALIDATIO	N COMP	OI ETENESS	S WORKSHEET		Date: 68/64
	#: 40000F3D VALIDATIO #: 20F0157		stage 2B	, MACKINGITE I	ļ	Page: \(\frac{1}{2}\) of \(\frac{1}{2}\)
	ratory: <u>Analytical Resources, Inc.</u>	_	lago 22		Rev	/iewer: <u>∕\${</u>
		CIMANE M	lathad BUBOV)		2nd Rev	riewer:
VI⊏ I I	HOD: GC Polychlorinated Biphenyls (EPA	(SVV 040 IVI	elilou ouozaj			
	samples listed below were reviewed for ea	ach of the fo	ollowing valida	tion areas. Validatior	n findings are not	ted in attached
valida	ation findings worksheets.					
	Validation Area			Comme	ents	
1.	Sample receipt/Technical holding times	AIA				
11.	Initial calibration/ICV	AISW	. 1,	CAL = 20%	124	202
III.	Continuing calibration	A		N 5 20/3		
IV.		A				
V.	Field blanks	N				
VI.	\(\sigma_c \)	A/A				
VII.		A				
VIII.		A	LCS			
IX.	Field duplicates	N				
X.	Compound quantitation/RL/LOQ/LODs	SIM				
XI.	Target compound identification	N				
XII	Overall assessment of data	<u> A </u>				
Note:	N = Not provided/applicable R = Rin	No compounds nsate ïield blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source I OTHER:	olank
	Client ID			Lab ID	Matrix	Date
1	LDW20-SC148C			20F0157-01	Sediment	06/08/20
2	LDW20-SC155B			20F0157-02	Sediment	06/08/20
3	LDW20-SC166C			20F0157-03	Sediment	06/08/20
4	LDW20-SC208B			20F0157-04	Sediment	06/08/20
5	LDW20-SC148CMS			20F0157-01MS	Sediment	06/08/20
6	LDW20-SC148CMSD			20F0157-01MSD	Sediment	06/08/20
7						
8	<u></u>					
9						
10					<u> </u>	
11						
12					1	1

- BIF0491-BLK1

(no SRM)

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:		

LDC #: 48680 F36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>l_of_l</u>	
Reviewer:	JVG	
2nd Reviewer:		

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? / %D or _ %R Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	Standard ID SIFU176 - SC	V1 20	BB	21.0	All (Det)	J/WJ/A
	7 (0700	1 - 1/0 - 0	V		2,,0	An Can	(gual Z AA BB)
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VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

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Reviewer: _	JVG
2nd Reviewer:	1
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	/	
METHOD:	/ GC	HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y_N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.? YN N/A

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%APD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	efo, 1	J dets A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

Although the low level check standard exceeded QC limits for arsenic, no data was qualified since all associated results were greater than 2X the reporting limit.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Zinc	2.3 mg/Kg	All samples in SDG 20F0157
ICB/CCB	Arsenic	0.028 ug/L	LDW20-SC166C

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680F4a Date: 7/30/20 SDG #: 20F0157 Stage 2B Page: 1 of 1 Laboratory: Analytical Resources, Inc. Reviewer:_A] 2nd Reviewer: 4 METHOD: Metals (EPA SW 846 Method 6020A/7471B) The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets. **Validation Area Comments** Sample receipt/Technical holding times A/A 11. ICP/MS Tune Α III. Instrument Calibration SW IV. ICP Interference Check Sample (ICS) Analysis Α Laboratory Blanks ٧. SW VI. Field Blanks Ν VII. Matrix Spike/Matrix Spike Duplicates Ν non-client sample used VIII. Duplicate sample analysis Ν IX. Serial Dilution Ν X. Laboratory control samples Α LCS/SRM XI. **Field Duplicates** Ν XII. Internal Standard (ICP-MS) Ν XIII. Sample Result Verification Ν XIV. Overall Assessment of Data Α Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank N = Not provided/applicable R = Rinsate TB = Trip blank OTHER: SW = See worksheet FB = Field blank EB = Equipment blank **Client ID** Matrix Lab ID Date LDW20-SC148C 20F0157-01 Sediment 06/08/20 2 LDW20-SC155B 20F0157-02 Sediment 06/08/20 3 LDW20-SC166C 20F0157-03 Sediment 06/08/20 LDW20-SC208B 20F0157-04 Sediment 06/08/20 5 6 8 9

Notes:

10 11 12 LDC #: 48680F4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1,2,3,4	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
	Analysis Method
ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEETS <u>Low Level Calibration Check</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

All low level calibration check standards were performed at the required frequency and were within the acceptance limits with the following exceptions:

					%R			
Date	Time	Calibration ID	Analyte	%R	Limits	Associated Samples	Qualification*	Det/ND
6/22/2020	14:01	SIF0327-CRL1	As	142	70-130	1,2,4	no qual	det > 2x RL
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Comments: *Only results that are non-detect or <2X the reporting limit require qualification.

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

All initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were performed at the required frequency and were within the acceptance limits with the following exceptions:

%R Associated							
Time	Calibration ID	Analyte	%R	Limits	Samples	Qualification	Det/ND
14:29	SIF0327-HCV2	Zn	87.7	90-110	1,2,4	no qual (samples were analyzed below ICAL range)	Det
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				Time Calibration ID Analyte %R	Time Calibration ID Analyte %R Limits	Time Calibration ID Analyte %R Limits Samples	Time Calibration ID Analyte %R Limits Samples Qualification 14:29 SIF0327-HCV2 Zn 87.7 90-110 1,2,4 no qual (samples were analyzed below ICAL range)

Comments:

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

				Sample Identification						
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	-						
Zn	2.3									

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 3

							Sample Identification				
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level								
As		0.028									
					_						

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680F6 Date: 7/30/20 SDG #: 20F0157 Stage 2B Page: 1_of_1 Laboratory: Analytical Resources, Inc. Reviewer: ATL 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	Α	
III.	Calibration verification	Α	
_IV	Laboratory Blanks	A	
v	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	cs
VII.	Duplicate sample analysis	Α	5
VIII.	Laboratory control samples	Α	LCS/SRM
IX.	Field duplicates	N	
_X.	Sample result verification	N	
XI.	Overall assessment of data	А	

A = Acceptable Note: ND = No compounds detected N = Not provided/applicable

SW = See worksheet

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5	LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20
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9				
10				
11				
12				
13				
14				
15				

Notes:		

LDC #: 48680F6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 4	TS, TOC
1	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC208B	20F0157-04	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0157	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0157

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0157	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC208B	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-SC208B	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

SDG # Labor MET F	#:20F0157 atory: <u>Analytical Resources, Inc.</u>	S ns/Dibenzo	Stage 2B ofurans (E	PA I			F Revio 2nd Revio					
	The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached ralidation findings worksheets.											
	Validation Area				Comm	ent	S					
<u>l.</u>	Sample receipt/Technical holding times	A/A	ļ									
11.	HRGC/HRMS Instrument performance check	Α										
111.	Initial calibration/ICV	A/A	ICA	L ≤ 2	0/35%		ICV ≤ QC L	imits				
IV.	Continuing calibration	sw	CC	V ≤ Q	C Limits							
V.	Laboratory Blanks	sw										
VI.	Field blanks	N										
VII.	Matrix spike/Matrix spike duplicates	N										
VIII.	Laboratory control samples	Α	0	PR, S	SRM	,						
IX.	Field duplicates	N										
Χ.	Labeled Compounds	Α										
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A									
XII.	Target compound identification	N										
XIII.	System performance	N										
XIV.	Overall assessment of data	Α	<u> </u>				····					
Note:	N = Not provided/applicable R = Rins	o compounds sate eld blank	s detected		D = Duplicate TB = Trip blank EB = Equipment blar	ık	SB=Source bl OTHER:	ank				
	Client ID				Lab ID	N	latrix	Date				
1	LDW20-SC208B				20F0157-04	s	Sediment	06/08/20				
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VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:			

LDC #: 48680F21_

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	<u>_1_</u> of_ <u>1_</u>
Reviewer:_	JVG
2nd Reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- $\frac{Y}{N}$ Was a routine calibration performed at the beginning of each 12 hour period?
- Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
							
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LDC #: 48680F21

VALIDATION FINDINGS WORKSHEET Blanks

	Page	_1_of_1_
	Reviewer:	JXG)
2nd	Reviewer:	V

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

 $\frac{Y}{Y}$ Were all samples associated with a method blank?

Was a method blank performed for each matrix and whenever a sample extraction was performed?

Was the method blank contaminated?

Blank extraction date: 06/22/20 Blank analysis date: _06/25/20 Associated samples: All (>5X) Conc. units: ng/Kg

Compound	Blank ID		Sample Identification						
	BIF0465-BLK1	(5x)							
В	0.175	0.88							
М	0.0946*	0.47							
0	0.166	0.83							
Q	0.521*	2.61							
G	1.32	6.60							
S	0.175	0.88							
Y	0.166	0.83							

*EMPC

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379DL	20F0186-05DL	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379FDDL	20F0186-06DL	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 7.0°C and 12.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0656-BLK1	06/23/20	Phenol	8.5 ug/Kg	All samples in SDG 20F0186

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT379	Phenol	16.0 ug/Kg	16.0U ug/Kg
LDW20-IT379FD	Phenol	14.0 ug/Kg	14.0U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379 LDW20-IT379DL)	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	139 (45-120)	162 (43-120) - 1430 (45-120) 2450 (49-120) 2260 (47-120) 1500 (30-160) 2160 (42-120) 740 (42-123) 471 (30-133) 756 (38-126)	J (all detects)	A

For LDW20-IT379MS/MSD, no data were qualified for fluoranthene, phenanthrene, and pyrene percent recoveries (%R) and relative percent differences (RPD) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379 LDW20-IT379DL)	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	38.4 (≤30) 37.5 (≤30) 41.6 (≤30) 126 (≤30) 122 (≤30) 112 (≤30) 116 (≤30) 120 (≤30) 93.6 (≤30) 100 (≤30) 87.3 (≤30)	J (all detects)	A

IX. Laboratory Control Samples/ Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0656-SRM1	Anthracene	55.9 (57-143)	All samples in SDG 20F0186	J (all detects)	Р

X. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD and samples LDW20-IT379DL and LDW20-IT379FDDL were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (ug/Kg)		
Compound	LDW20-IT379	LDW20-IT379FD	RPD
Phenol	16.0	14.0	13
Naphthalene	29.7	53.0	56
2-Methylnaphthalene	25.6	37.0	36

	Concentration (ug/Kg)		
Compound	LDW20-IT379	LDW20-IT379FD	RPD
Acenaphthylene	13.4	24.1	57
Acenaphthene	252	246	2
Dibenzofuran	74.2	123	49
Fluorene	184	223	19
Phenanthrene	2230	3030	30
Anthracene	665	878	28
Fluoranthene	3800	4170	9
Pyrene	3720	4010	8
Benzo(a)anthracene	1670	1820	9
Chrysene	1900	2050	8
Benzofluoranthenes, total	2130	2410	12
Benzo(a)pyrene	1520	1690	. 11
Indeno(1,2,3-cd)pyrene	702	759	8
Dibenzo(a,h)anthracene	237	263	10
Benzo(g,h,i)perylene	813	800	2

	Concentra		
Compound	LDW20-IT379DL	LDW20-IT379FDDL	RPD
Acenaphthene	258	257	0
Dibenzofuran	68.1	121	56
Fluorene	211	247	16
Phenanthrene	2230	3010	30
Anthracene	664	864	26

	Concentra		
Compound	LDW20-IT379DL	LDW20-IT379FDDL	RPD
Fluoranthene	3930	4400	11
Pyrene	3850	4210	9
Benzo(a)anthracene	1670	1840	10
Chrysene	1870	2070	10
Benzofluoranthenes, total	2140	2380	11
Benzo(a)pyrene	1510	1640	8
Indeno(1,2,3-cd)pyrene	706	769	9
Dibenzo(a,h)anthracene	235	325	32
Benzo(g,h,i)perylene	733	831	13

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-IT379	Phenanthrene Fluoranthene Pyrene	Results exceeded calibration range.	Not reportable	А
LDW20-IT379DL	All compounds except Phenanthrene Fluoranthene Pyrene	Results from undiluted analyses were more usable.	Not reportable	А
LDW20-IT379FD	Phenanthrene Fluoranthene Pyrene Chrysene	Results exceeded calibration range.	Not reportable	Α
LDW20-IT379FDDL	All compounds except Phenanthrene Fluoranthene Pyrene Chrysene	Results from undiluted analyses were more usable.	Not reportable	А

Due to MS/MSD %R and RPD and SRM %R, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT379	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT379	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
LDW20-IT379 LDW20-IT379FD	Anthracene	J (all detects)	Р	Standard reference materials (%R)
LDW20-IT379	Phenanthrene Fluoranthene Pyrene	Not reportable	А	Overall assessment of data
LDW20-IT379DL	All compounds except Phenanthrene Fluoranthene Pyrene	Not reportable	A	Overall assessment of data
LDW20-IT379FD	Phenanthrene Fluoranthene Pyrene Chrysene	Not reportable	A	Overall assessment of data
LDW20-IT379FDDL	All compounds except Phenanthrene Fluoranthene Pyrene Chrysene	Not reportable	A	Overall assessment of data

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT379	Phenol	16.0U ug/Kg	Α
LDW20-IT379FD	Phenol	14.0U ug/Kg	Α

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

SDG # .abor	t: 48680G2a VALIDATIC t: 20F0186 atory: Analytical Resources, Inc. IOD: GC/MS Semivolatiles (EPA SW 846	S	tage 2B	SS WORKS	SHEET		Date: 08/05/ Page: _of _ Reviewer: _\o Reviewer: _	
	amples listed below were reviewed for eation findings worksheets.	ch of the fo	ollowing va	lidation areas.	Validation 1	indings are	noted in attached	
	Validation Area				Commen	ts	Ansufficient	
l.	Sample receipt/Technical holding times	SW, A	Crole	r temps =	12.4℃	7.00	time to cool	
11.	GC/MS Instrument performance check	LA				****		
111.	Initial calibration/ICV	AIA		H = 203	VY	10	N=36?	
IV.	Continuing calibration	A	ca	1 = 20%				
V.	Laboratory Blanks	SW						
VI.	Field blanks	N						
VII.	Surrogate spikes	Δ						
VIII.	Matrix spike/Matrix spike duplicates	SW						
IX.	Laboratory control samples	SW	US SRM					
X.	Field duplicates	SW	<u> </u>	= 1/3 2	16			
XI.	Internal standards	A						
XII.	Compound quantitation RL/LOQ/LODs	N.						
XIII.	Target compound identification	N						
XIV.	System performance	N						
XV.	Overall assessment of data	SW						
ote:	N = Not provided/applicable R = Rin	lo compounds isate eld blank	detected D =	Duplicate TB = Trip bl EB = Equipr	ank	Source blank OTHER:		
	Client ID			Lab ID		Matrix	Date	
<u> </u>	.DW20-IT379			20F0186-05		Sediment	06/09/20	
2 1	DW20-IT379RE) L			20F0186-05R	±DL .	Sediment	06/09/20	
3 1	DW20-IT379FD			20F0186-06		Sediment	06/09/20	
<u> </u>	DW20-1T379MS	20F0186-05M	ıs	Sediment	06/09/20			
5 L	DW20-IT379MSD	20F0186-05M	ISD	Sediment	06/09/20			
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VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthaiene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachiorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzofluoranthenes, total

LDC #: 48686 G120	C
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VALIDATION FINDINGS WORKSHEET Blanks

Page:	o	f
Reviewer:	JV	<u>G</u>
2nd Reviewer:_	\underline{a}	

METHOD: GC/MS BNA (EPA SW 846 Method 8270¢)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

M N N/A Was a method blank analyzed for each matrix?

Y N N/A Was a method blank analyzed for each concentration preparation level?

Blank analysis date:

Y N N/A Was a method blank associated with every sample?

Was the blank contaminated? If yes, please see qualification below. Blank extraction date: 06/23/20 Blank analysis date: 06/27/20

AII Conc. units: 40 / kg Associated Samples: Compound Blank ID BIF 0656-Blk1 16.0/U 14.0 lu 8.5

Conc. units:	Conc. units: Associated Samples:									
Compound	Blank ID									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Blank extraction date:

LDC #: 486 80 G20

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:_	\perp	of	L
Reviewer:_	Ĵ۱	/G	•
2nd Reviewer:_	\overline{Z}		
_		7	

METHOD: GC/MS BNA (EPA SW 846 Method 82702)
Please see qualifications below for all accounts. Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an

associated MS/MSD. Soil / Water.

Was a MS/MSD analyzed every 20 samples of each matrix?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)		MSD %R (Limits)		RPD (Limits)	Associated Samples	Qualifications
		4/5	See	attached)	()	()	1, 2	see attached
				()	()	()	(A11 bet)	
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MS / MS DUPLICATE RECOVERY EPA 8270E

Laboratory:

Analytical Resources, Inc.

SDG:

20F0186

Client:

Anchor QEA, LLC

Project:

Lower Duwamish AOC4

Matrix:

Solid

Analyzed:

06/27/20 14:34

Batch:

BIF0656

Laboratory ID:

BIF0656-MS1

Preparation:

EPA 3546 (Microwave)

Sequence Name:

Matrix Spike

Initial/Final:

13.21 g / 1 mL

Source Sample:

LDW20-IT379

COMPOUND		SPIKE ADDED (ug/kg dry)	SAMPLE CONCENTRATION (ug/kg dry)	Q	MS CONCENTRATION (ug/kg dry)	Q	MS % REC.#		QC LIMITS REC.	
Phenol		500	16.0	J	367		70.2	1	34 - 120	
4-Methylphenol		500	ND	U	397		79.4		29 - 120	
Naphthalene		500	29.7		422		78.4		43 - 120	
2-Methylnaphthalene		500	25.6		439		82.7		43 - 120	
Acenaphthylene		500	13.4	J	407		78.6		42 - 120	
Dimethylphthalate		500	ND	U	408		81.6		43 - 120	
Acenaphthene	GG	500	252		947	*	139	*	45 - 120	Jets A
Dibenzofuran		500	74.2		606		106		43 - 120	
Fluorene	NN	500	184		843	*	132	*	45 - 120	Jdets/A
Phenanthrene	ии	500	2230	Е	5300	*, E	614	*	49 - 120	NA X
Anthracene	٧٧	500	665		1780	*	224	*	45 - 120	Jdets/A
Fluoranthene	77	500	3800	Е	6780	*, E	597	*	53 - 120	NOX
Pyrene	22	500	3720	Е	6680	*, E	591	*	48 - 121	
Butylbenzylphthalate		500	ND	U	403		80.5		45 - 132	
Benzo(a)anthracene	w	500	1670		3380	*, E	341	*	49 - 120	Jetsa
Chrysene	DDD	500	1900		3700	*, E	361	*	47 - 120	$\exists \iota$
bis(2-Ethylhexyl)phthalate		500	ND	U	390		77.9		34 - 130	
Benzofluoranthenes, Total	A2	1000	2130		4570	*, E	244	*	30 - 160	Jdets/A
Benzo(a)pyrene	III	500	1520		3100	*, E	317	*	42 - 120	
Indeno(1,2,3-cd)pyrene	JJJ	500	702		1600	*	179	*	42 - 123	
Dibenzo(a,h)anthracene		500	237		864		125		30 - 133	
Benzo(g,h,i)perylene	LLL	500	813		1800	*	198	*	38 - 126	Jdets /

^{*} Values outside of QC limits

* Parent conc
> 4x spike





MS / MS DUPLICATE RECOVERY EPA 8270E

Laboratory: Analytical Resources, Inc. SDG: 20F0186

Client: Anchor QEA, LLC Project: Lower Duwamish AOC4

Matrix: <u>Solid</u> Analyzed: <u>06/27/20 15:10</u>

Batch: BIF0656 Laboratory ID: BIF0656-MSD1

Preparation: EPA 3546 (Microwave) Sequence Name: Matrix Spike Dup

Initial/Final: 13.21 g / 1 mL Source Sample: LDW20-IT379

		SPIKE	MSD		MSD			QC	LIMITS	
COMPOUND		ADDED (ug/kg dry)	CONCENTRATION (ug/kg dry)	Q	% REC. #		% RPD #	RPD	REC. 22 7	?e=
Phenol		500	386		74.0		4.96	30	34 - 120	
4-Methylphenol		500	413		82.6		4.04	30	29 - 120	
Naphthalene	-	500	443		82.6		4.88	30	43 - 120	
2-Methylnaphthalene	,	500	457		86.2		3.93	30	43 - 120	
Acenaphthylene		500	433		83.9		6.26	30	42 - 120	
Dimethylphthalate		500	417		83.3		2.09	30	43 - 120	
Acenaphthene	GG	500	642	*	78.0		38.4 *	30	45 - 120 J	det,
Dibenzofuran	IJ	500	887	*	162	*	37.5 *	30	45 - 120 Jdets/4	(-)
Fluorene	KN	500	553	*	73.7		41.6 *	30	45 - 120 J	ldet
Phenanthrene	UU	500	24200	*, E	4400	*	128 *	30	49 - 120 N6.7	٢
Anthracene	V √	500	7840	*, E	1430	*	126 *	30	49 - 120 NG N 45 - 120 Jet 1 53 - 120 NG	4-3
Fluoranthene	Ϋ́Υ	500	23300	*, E	3890	*	110 *	30	53 - 120 NS	*
Pyrene	22	500	21100	*, E	3480	*	104 *	30	48 - 121	
Butylbenzylphthalate		500	414		82.8		2.83	30	45 - 132	
Benzo(a)anthracene	ca	500	13900	*, E	2450	*	122 *	30	49-120 Jets	(- -)
Chrysene	חמל	500	13200	*, E	2260	*	112 *	30	47 - 120	. ,
bis(2-Ethylhexyl)phthalate		500	450		90.0		14.4	30	34 - 130	
Benzofluoranthenes, Total	A2	1000	17100	*, E	1500	*	116 *	30	30-160 Jdets/A	Ĺ
Benzo(a)pyrene	III	500	12300	*, E	2160	*	120 *	30	42 - 120	' '
Indeno(1,2,3-cd)pyrene	JJJ	500	4400	*, E	740	*	93.6 *	30	42 - 123	
Dibenzo(a,h)anthracene	KKK	500	2590	*, E	471	*	100 *	30	30 - 133	
Benzo(g,h,i)perylene	LLL	500	4590	*, E	756	*	87.3 *	30	38 - 126	

^{*} Values outside of QC limits

LDC #: 48680 C924

N/A

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> / SKM

Page: __lof___)
Reviewer: __JVG
2nd Reviewer: ____

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0696-SRM1	VV	55.9 (57-H3	()	()	All (Det)	JUZA
			()	()	()		7 ***
			()	()	()		
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LDC#: 48680G2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_1_of_1_ Reviewer: JVG 2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)
Y N NA
Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentra	Concentration (ug/Kg)				
Compound	1	1 3				
Α	16.0	14.0	13			
s	29.7	53.0	56			
w	25.6	37.0	36			
DD	13.4	24.1	57			
GG	252	246	2			
າາ	74.2	123	49			
NN	184	223	19			
υυ	2230	3030	30			
w	665	878	28			
YY	3800	4170	9			
ZZ	3720	4010	8			
ccc	1670	1820	9			
DDD	1900	2050	8			
A2	2130	2410	12			
III.	1520	1690	11			
JJJ	702	759	8			
ккк	237	263	10			
LLL	813	800	2			

	Concentra	Concentration (ug/Kg)				
Compound	2	6	RPD			
GG	258	257	0			
าา	68.1	121	56			
NN	211	247	16			
υυ	2230	3010	30			
w	664	864	26			
YY	3930	4400	11			
ZZ	3850	4210	9			
ccc	1670	1840	10			
DDD	1870	2070	10			
A2	2140	2380	11			
#	1510	1640	8			
JIJ	706	769	9			
ккк	235	325	32			
LLL	733	831	13			

LDC#: 48680G2a

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

	f <u> </u>
JV	<u> </u>
	JV

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

YN N/A

Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
			uu yy ZZ	7 cal range	NR/A
			1		
		2	All except above	dil	
		3	UU, YY, ZZ, DDD	7 cal range	
			100, 77, 22, 370	, , , , , , ,	
		4	All except above	di	/
	•				
	·				

Comments:			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0109	UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/27/20	Benzoic acid	22.9	All samples in SDG 20F0109	J (all detects)	А

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0656-BLK2	06/23/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.1 ug/Kg 1.0 ug/Kg	All samples in SDG 20F0109

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT379	1,4-Dichlorobenzene	2.5 ug/Kg	2.5U ug/Kg
	1,2-Dichlorobenzene	1.6 ug/Kg	1.6U ug/Kg
LDW20-IT379FD	1,4-Dichlorobenzene	1.9 ug/Kg	1.9U ug/Kg
	1,2-Dichlorobenzene	0.9 ug/Kg	0.9U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-IT379 LDW20-IT379FD		RPD
1,4-Dichlorobenzene	2.5	1.9	27
1,2-Dichlorobenzene	1.6	0.9	56
Benzyl alcohol	6.2	6.7	8
Benzoic acid	65.9	73.8	11
2,4-Dimethylphenol	2.8	2.4	15
1,2,4-Trichlorobenzene	4.1	5.0U	Not calculable
Pentachlorophenol	8.4	3.1	92

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and continuing calibration %D, data were qualified as estimated in two samples.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-IT379 LDW20-IT379FD	N-Nitrosodiphenylamine	UJ (all non-detects)	Α	Initial calibration verification (%D)
LDW20-IT379 LDW20-IT379FD	Benzoic acid	J (all detects)	А	Continuing calibration (%D)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT379	1,4-Dichlorobenzene 1,2-Dichlorobenzene	2.5U ug/Kg 1.6U ug/Kg	А
LDW20-IT379FD	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.9U ug/Kg 0.9U ug/Kg	А

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

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				WORKSHE	ET	Date: 08/06
	#:20F0186 ratory: <u>Analytical Resources, Inc.</u>	3	stage 2B			Page: <u>\</u> of_ Reviewer: 🐼
						Reviewer: 2nd Reviewer:
METH	タッカ H OD : GC/MS Polynuclear Aromatic Hyd	drocarbons (E	EPA SW 846 N	Method 8270E-S	SIM)	•
	amples listed below were reviewed for e tion findings worksheets.	each of the fo	ollowing valida	tion areas. Valid	lation findings	s are noted in attach
	Validation Area			Co	mments	
ı.	Sample receipt/Technical holding times	SALA	Cooler tem	ps = 12,4°C		Insufficient time to cool
11.	GC/MS Instrument performance check	A				
Ш.	Initial calibration/ICV	AISW	ICAL	£ 20%	~	IW = 30/3
IV.	Continuing calibration	SW	CW=	= 20%		
V.	Laboratory Blanks	SW				
VI.	Field blanks	N			· · · · · · · · · · · · · · · · · · ·	
VII.	Surrogate spikes	A		****		
VIII.	Matrix spike/Matrix spike duplicates	À				
IX.	Laboratory control samples	A	l	cs, sr	M	
X.	Field duplicates	SW	₽	= 1/2		
XI.	Internal standards	A				
XII.	Compound quantitation RL/LOQ/LODs	N				
XIII.	Target compound identification	N				
XIV.	System performance	N		-		
XV.	Overall assessment of data	A				
Note:	N = Not provided/applicable R = F	= No compounds Rinsate = Field blank	detected	D = Duplicate TB = Trip blank EB = Equipment	ОТ	3=Source blank ГНЕR:
	Client ID			Lab ID	Matrix	Date
1 1	LDW20-IT379			20F0186-05	Sedime	ent 06/09/20
	LDW20-iT379FD			20F0186-06	Sedime	ent 06/09/20
ll I	LDW20-IT379MS			20F0186-05MS	Sedime	ent 06/09/20
4 1	LDW20-IT379MSD			20F0186-05MSD	Sedime	ent 06/09/20
5 6 7						
7						

BIF 0656-BLK2

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF, Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

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	8680

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	1 of 1
Reviewer:	JУG
2nd Reviewer:_	4

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Was an initial calibration verification standard analyzed after each ICAL for each instrument when the validation criteria of \$29/30% %D? Was an initial calibration verification standard analyzed after each ICAL for each instrument? Were all %D within the validation criteria of \$29/30% %D?

H	N N/A Were all %D within the validation criteria of €29/30% %D ?							
#_	Date	Standard ID	Compound	Finding %D (Limit: ⊴20.0%/ 30%)	Associated Samples	Qualifications		
	06/24/20	SI F0395-SCV1	QQ	65.7	A11 (NO)	J/uJ/A		
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LDC #: 48680 GZb

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page:_	of
Reviewer:	1X-6
2nd Reviewer:	J

SV0A METHOD: GC/MS PAH (EPA SW 846 Method 8270) SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y N N/A

Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)		Finding RRF				
					(Limit)	Associated Samples	Qualifications			
L	06/27/20	NT14 200627035	PPP	22.9		All (Pet)	J/UJ/A			
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LDC #:	486	80G	26

VALIDATION FINDINGS WORKSHEET Blanks

Page:_	lof)	
Reviewer:	JДG	
nd Reviewer:_	(1	_

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

216	ease see	qualifications	below for all	questions	answered "N".	. Not applicable	questions a	re identified as "N/A".

Y\N N/A Was a method blank analyzed for each matrix?

Y N N/A Was a method blank analyzed for each concentration preparation level?

Y/N N/A Was a method blank associated with every sample?

Was the blank contaminated? If yes, please see qualification below. Blank extraction date: 06/23/20 Blank analysis date: 06/27/20 Conc. units: ua /-Associated Samples:

	Accordated campies.									
	Compound	Blank ID								
		BI F 06 56-	BU(2	1	2					
CRL.	E	1.		2.5/U	1.9/4					
	F	1.0		1.6/	0.9/1					
					,					
		-								

An

Blank analysis date: Blank extraction date:

Conc. units: Associated Samples:

Compound	Blank ID				
e de la companya de l					
·	·				
					 ,

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC#: 48680G2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)

YN NA

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentra		
Compound	1	2	RPD
E	2.5	1.9	27
F	1.6	0.9	56
QQQ	6.2	6.7	8
PPP	65.9	73.8	11
0	2.8	2.4	15
R	4.1	5.0U	NC
TT	8.4	3.1	92

V:\Josephine\FIELD DUPLICATES\48680G2b windward duwamish.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 12.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G3a VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0186 Stage 2B Laboratory: Analytical Resources, Inc.

Date: 08/64/20
Page: 1 of 1
Reviewer: 2nd Reviewer:

SB=Source blank

OTHER:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	
I.	Sample receipt/Technical holding times	SNIA	Cooler temp = 12.4°C	Insufficient time
II.	GC Instrument Performance Check	l H	•	to cool
III.	Initial calibration/ICV	AIA	1CAL = 201	WE 20 L
IV.	Continuing calibration	A	CW & 20 %	
V.	Laboratory Blanks	A		
VI.	Field blanks	N		
VII.	Surrogate spikes / (5	A/X		
VIII.	Matrix spike/Matrix spike duplicates	A		
IX.	Laboratory control samples	A		
X.	Field duplicates	ND	D = 1/2	
XI.	Compound quantitation/RL/LOQ/LODs	N		
XII.	Target compound identification	N		
XIII.	System Performance	N		
ΧIV	Overall assessment of data	<u> </u>		

	Client ID	Lab ID	Matrix	Date
1-	LDW20-IT379	20F0186-05	Sediment	06/09/20
2	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
3	LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
4	LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
5				
6				
7				
8				
9				
10_				
Notes	•			

D = Duplicate

TB = Trip blank

EB = Equipment blank

ND = No compounds detected

R = Rinsate

FB = Field blank

BIF 0589- MALL

A = Acceptable

N = Not provided/applicable SW = See worksheet

Note:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT356MS	20F0186-01MS	Sediment	06/09/20
LDW20-IT356MSD	20F0186-01MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0186	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-IT379	LDW20-IT379FD	RPD
Aroclor-1248	8.1	8.4	4
Aroclor-1254	9.2	9.2	0
Aroclor-1260	21.1	25.5	19

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-IT377	Aroclor-1248	40.8	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and RPD between two columns, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT356 LDW20-IT369 LDW20-IT372 LDW20-IT377 LDW20-IT379 LDW20-IT379FD	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	А	Initial calibration verification (%D)
LDW20-IT377	Aroclor-1248	J (all detects)	А	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

SDG#	:48680G3bVALIDATI ::20F0186 :tory:_Analytical Resources, Inc.		ETENESS ige 2B	S WORKSHEET		Date: <u> & /¢</u> Page: <u> </u> ↓of_ eviewer: <u> </u> ∆ eviewer:
VETH (OD: GC Polychlorinated Biphenyls (EF	PA SW846 Met	hod 8082A)		ZHU INC	Wiewei
	imples listed below were reviewed for elements in findings worksheets.	each of the follo	owing validat	tion areas. Validation	า findings are no	oted in attach
	Validation Area			Comme	ents	
1.	Sample receipt/Technical holding times	SW, A	Cooler			time to a
II.	Initial calibration/ICV	AISW	ICA	41. 420/	IW	€ 20%.
III.	Continuing calibration	A	CON	temp = 12,4°C, AL 620%. 620%		
IV.	Laboratory Blanks				<u> </u>	
V.	Field blanks	N				<u> </u>
VI.	Surrogate spikes / \$	A/A				
VII.	Matrix spike/Matrix spike duplicates	A				
VIII.	Laboratory control samples	A	U	SID , SRN		
IX.	Field duplicates	SW	D	5/D, SRN $= 5/6$		
Х	Compound quantitation/RL/LOQ/LODs	SIM		,		
XI.	Target compound identification	N				
XII	Overall assessment of data	TAL				
Note:	N = Not provided/applicable R = F	= No compounds d Rinsate = Field blank	etected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source OTHER:	e blank
C	Client ID			Lab ID	Matrix	Date
1 L	.DW20-IT356			20F0186-01	Sediment	06/09/20
	.DW20-IT369			20F0186-02	Sediment	06/09/20
	.DW20-IT372			20F0186-03	Sediment	06/09/20
	DW20-IT377			20F0186-04	Sediment	06/09/20
	.DW20-IT379))			20F0186-05	Sediment	06/09/20
6 L	.DW20-IT379FD /			20F0186-06	Sediment	06/09/20
7 L	DW20-IT356MS			20F0186-01MS	Sediment	06/09/20
8 L	DW20-IT356MSD			20F0186-01MSD	Sediment	06/09/20
9						
10						
11						
12						

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ çis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:		

LDC #: 4868063b

VALIDATION FINDINGS WORKSHEET <u>Initial Calibration Verification</u>

Page: ___of___ Reviewer: __JVG 2nd Reviewer: ____

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? __%D or __%R

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N	N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?						
#	Date	Standard ID	Detector/	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SC	N1 2c	BB	21.0	All (bet)	
		•					J/WJ/A (qual 2, AA BB)
					·		
		•				3	
			<u> </u>		·		
			1				
					·		
					·		
		·			·		
				·			

LDC#: 48680G3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GC PCB (EPA SW 846 Method 8082A)

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentra	200	
Compound	5	6	RPD
Aroclor 1248	8.1	8.4	4
Aroclor 1254	9.2	9.2	0
Aroclor 1260	21.1	25.5	19

V:\Josephine\FIELD DUPLICATES\48680G3b windward duwamish.wpd

LDC #: 48680G3b

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page:	<u></u> of
Reviewer:	JVG '
2nd Reviewer	-4_

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

ØN N/A

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

	ii iio, piease see iiidiiigi			
#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	2	4	40.8	J dets /A

		<u> </u>	I	

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
LDW20-IT379DUP	20F0186-05DUP	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Zinc	2.3 mg/Kg	LDW20-IT379
ICB/CCB	Silver	0.027 ug/L	LDW20-IT379 LDW20-IT379FD

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-IT379	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-IT379FD	Silver	0.14 mg/Kg	0.14U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379FD)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	А
LDW20-IT334MS/MSD (LDW20-IT379FD)	Mercury	-	127 (75-125)	J (all detects)	А

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379FD)	Silver	23 (≤20)	J (all detects)	А

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (mg/Kg)		
Analyte	LDW20-IT379	LDW20-IT379FD	RPD
Arsenic	4.65	5.12	10
Cadmium	0.16	0.15	6
Chromium	24.8	15	49
Copper	24.4	23.9	2
Lead	11.4	13.2	15
Mercury	0.0853	0.0467	58
Silver	0.16	0.14	13
Zinc	51.3	53.1	3

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0186

Sample	Analyte	Flag	A or P	Reason
LDW20-IT379FD	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT379FD	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Analyte	Modified Final Concentration	A or P
LDW20-IT379	Silver	0.16U mg/Kg	A
LDW20-IT379FD	Silver	0.14U mg/Kg	Α

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

LDC #: 48680G4a SDG #: 20F0186

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: 1 of 1 Reviewer: ATL

2nd Reviewer:

Date: 7/30/20

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
ı.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
111.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	z	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	(7,8), From SDG # 20F0191 (LDW20-IT334MS/MSD)
VIII.	Duplicate sample analysis	Α	9, From SDG # 20F0191 (LDW20-IT334DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	sw	(5,6)
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT356	20F0186-01	Sediment	06/09/20
2	LDW20-IT369	20F0186-02	Sediment	06/09/20
3	LDW20-IT372	20F0186-03	Sediment	06/09/20
4	LDW20-IT377	20F0186-04	Sediment	06/09/20
5	LDW20-IT379	20F0186-05	Sediment	06/09/20
6	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
7	LDW20-IT379FDMS	20F0186-06MS	Sediment	06/09/20
8	LDW20-IT379FDMSD	20F0186-06MSD	Sediment	06/09/20
9	LDW20-IT379FDDUP	20F0186-06DUP	Sediment	06/09/20
10				
11				
12				
13				

LDC #: 48680G4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
5,6	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1 to 4	As
QC	
7,8,9	Cr,Pb,Ag,As,Cd,Cu,Zn
<u></u>	
	Analysis Method
ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 5

				Sample Identification								
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level									
Zn	2.3											

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 5,6

				Sample Identification								
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	5	6							
Ag		0.027		0.16	0.14							

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
7 & 8	S	Ag	34.1		75-125				J/UJ/A	Det
		Ag				23	20	6	J/UJ/A	Det
LDW20-IT334		Hg		127	75-125			6	Jdet/A	Det
				<u> </u>		<u> </u>				<u> </u>
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Comments:

LDC #: 48680G4a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer: ATL

Method: Metals

A	Concentrat	tion (mg/kg)	RPD	0 117 (0 1)
Analyte	5	6		Qualifiers (Parents Only)
Arsenic	4.65	5.12	10	
Cadmium	0.16	0.15	6	
Chromium	24.8	15	49	
Copper	24.4	23.9	2	
Lead	11.4	13.2	15	
Mercury	0.0853	0.0467	58	
Silver	0.16	0.14	13	
Zinc	51.3	53.1	3	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (%)		
Analyte	LDW20-IT379	LDW20-IT379FD	RPD
Total solids	75.63	74.61	1
Total organic carbon	0.56	0.83	39

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G6

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0186

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 7/30/20 Page: 1 of 1 Reviewer: ATL 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
<u>I.</u>	Sample receipt/Technical holding times	A/A	
	Initial calibration	А	
111.	Calibration verification	Α	
IV	Laboratory Blanks	Α	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	cs
VII.	Duplicate sample analysis	Α	From SDG # 20F0157 (LDW20-SC148C DUP)
VIII.	Laboratory control samples	Α	LCS/SRM
IX.	Field duplicates	sw	(5,6)
X.	Sample result verification	N	
XI.	Overall assessment of data	А	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT356	20F0186-01	Sediment	06/09/20
2	LDW20-IT369	20F0186-02	Sediment	06/09/20
3	LDW20-IT372	20F0186-03	Sediment	06/09/20
4	LDW20-IT377	20F0186-04	Sediment	06/09/20
5	LDW20-IT379	20F0186-05	Sediment	06/09/20
6	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:	 	 	
		_	
	_		

LDC #: 48680G6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 6	TS, TOC

LDC#: 48680G6

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

	Concentration (%)			
Analyte	5	6	RPD	Qualifiers (Parents Only)
Total Solids	75.63	74.61	1	
Total Organic Carbon	0.56	0.83	39	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 7.0°C and 12.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0186	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0186

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT356	1,2,3,7,8-PeCDD	0.449 ng/Kg	0.449U ng/Kg
	2,3,4,6,7,8-HxCDF	0.355 ng/Kg	0.355U ng/Kg
LDW20-IT369	1,2,3,7,8-PeCDD	0.507 ng/Kg	0.507U ng/Kg
	2,3,4,6,7,8-HxCDF	0.353 ng/Kg	0.353U ng/Kg
LDW20-IT379	1,2,3,7,8-PeCDD	0.756 ng/Kg	0.756U ng/Kg
	2,3,4,6,7,8-HxCDF	0.448 ng/Kg	0.448U ng/Kg
LDW20-IT379FD	1,2,3,7,8-PeCDD	0.439 ng/Kg	0.439U ng/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (ng/Kg)		
Compound	LDW20-IT379	LDW20-IT379FD	RPD
2,3,7,8-TCDD	0.284	0.986U	Not calculable
1,2,3,7,8-PeCDF	0.328	0.363	10
2,3,4,7,8-PeCDF	0.624	0.737	17
1,2,3,7,8-PeCDD	0.756	0.439	53
1,2,3,4,7,8-HxCDF	0.861	0.817	5
1,2,3,6,7,8-HxCDF	0.6055	0.533	13
2,3,4,6,7,8-HxCDF	0.448	0.479	7
1,2,3,7,8,9-HxCDF	0.164	0.202	21
1,2,3,4,7,8-HxCDD	0.788	0.749	5
1,2,3,6,7,8-HxCDD	2.97	3.40	14
1,2,3,7,8,9-HxCDD	1.14	1.06	7
1,2,3,4,6,7,8-HpCDF	6.90	7.61	10
1,2,3,4,7,8,9-HpCDF	0.539	0.530	2
1,2,3,4,6,7,8-HpCDD	75.1	158	71
OCDF	12.1	22.4	60
OCDD	379	793	71
Total TCDF	1.39	4.80	110
Total TCDD	0.834	1.08	26

	Concentra		
Compound	LDW20-IT379	LDW20-IT379FD	RPD
Total PeCDF	6.23	8.98	36
Total PeCDD	1.72	3.04	55
Total HxCDF	11.5	14.4	22
Total HxCDD	26.3	25.3	4
Total HpCDF	20.3	25.6	23
Total HpCDD	144	262	58

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
LDW20-IT379	13C12-1,2,3,4,7,8-HxCDF 13C12-1,2,3,6,7,8-HxCDF 13C12-2,3,4,6,7,8-HxCDF 13C12-1,2,3,4,7,8-HxCDD 13C12-1,2,3,6,7,8-HxCDD	160 (26-152) 130 (26-123) 162 (28-136) 155 (32-141) 148 (28-130)	1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD	J (all detects)	P

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0186	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration concentration, labeled compound %R, and compounds reported as EMPC, data were qualified as estimated in four samples.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT356 LDW20-IT369 LDW20-IT379 LDW20-IT379FD	1,2,3,4,7,8,9-HpCDF	J (all detects)	Р	Continuing calibration (concentration)
LDW20-IT379	1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD	J (all detects)	Р	Labeled compounds (%R)
LDW20-IT356 LDW20-IT369 LDW20-IT379 LDW20-IT379FD	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT356	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.449U ng/Kg 0.355U ng/Kg	А
LDW20-IT369	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.507U ng/Kg 0.353U ng/Kg	А
LDW20-IT379	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.756U ng/Kg 0.448U ng/Kg	А
LDW20-IT379FD	1,2,3,7,8-PeCDD	0.439U ng/Kg	Α

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

SDG Labo MET The	#:48680G21VALIDATIO #:20F0186 pratory: Analytical Resources, Inc. THOD: HRGC/HRMS Polychlorinated Dioxi samples listed below were reviewed for ea ation findings worksheets.	S ns/Dibenz	Stage 2B ofurans (EF	PA I	•	I Revi 2nd Rev			
	Validation Area				Comme	ents			
<u> </u>	Sample receipt/Technical holding times	SW/A	Cooler temp	<u>) = 12</u>	2.4 deg C, 7.0 deg C	(Insufficie	nt time to cool)		
11.	HRGC/HRMS Instrument performance check	Α							
111.	Initial calibration/ICV	A/A	ICA	L ≤ 2	0/35%	ICV ≤ QC	Limits		
IV.	Continuing calibration	sw	CC/	/	C Limits				
V.	Laboratory Blanks	sw							
VI.	Field blanks	N							
VII	. Matrix spike/Matrix spike duplicates	N		_					
VIII	. Laboratory control samples	Α	OF	PR, S	SRM				
IX.	Field duplicates	sw	D = 3/4						
<u>x.</u>	Labeled Compounds	Α							
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets						
XII	Target compound identification	N							
XIII	. System performance	N							
ΧIV	Overall assessment of data	Α							
Note:	N = Not provided/applicable R = Rin	o compounds sate eld blank	s detected		D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source b OTHER:	olank		
	Client ID				Lab ID	Matrix	Date		
1	LDW20-IT356				20F0186-01	Sediment	06/09/20		
2	LDW20-IT369		· · · · · · · · · · · · · · · · · · ·		20F0186-02	Sediment	06/09/20		
3	LDW20-IT379				20F0186-05	Sediment	06/09/20		
4	LDW20-IT379FD				20F0186-06	Sediment	06/09/20		
5									
6		-							
7		· · · · · · · · · · · · · · · · · · ·							
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9				一	· · · · · · · · · · · · · · · · · · ·				
10									
lotes									
_	BIF0465-BLK1								

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:		 		_	 						

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	1	_of_	1	
Reviewer:		JVQ	ì	
2nd Reviewer:		7	1)	_
		$\overline{}$	•	_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- <u>Y</u> <u>N</u> <u>Y</u> Was a routine calibration performed at the beginning of each 12 hour period?
 Were all concentrations within method QC limits for unlabeled and labeled compounds?
- Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)
		<u> </u>					```
<u> </u>							

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET Blanks

	Page	<u>1</u> of 1
	Reviewer:	JXG_
2nd	Reviewer:	4

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- $\frac{Y}{Y}$ Were all samples associated with a method blank?
- Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Was the method blank contaminated?

Blank extraction date: 06/22/20 Blank analysis date: 06/25/20 Associated samples: Conc. units: ng/Kg

Compound	Blank ID			Sample Identification								
	BIF0465-BLK1	(5x)	1	2	3	4						
В	0.175	0.88	0.449/U	0.507/U	0.756/U	0.439/U						
М	0.0946*	0.47	0.355/U	0.353/U	0.448/U							
0	0.166	0.83										
Q	0.521*	2.61										
G	1.32	6.60										
s	0.175	0.88										
Y	0.166	0.83										

*EMPC

LDC#: 48680G21

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)
Y N NA
Y N NA
Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concent	ration (ng/Kg)	
Compound	3	4	RPD
А	0.284	0.986U	NC
1	0.328	0.363	10
J	0.624	0.737	17
В	0.756	0.439	53
К	0.861	0.817	5
L	0.6055	0.533	13
М	0.448	0.479	7
N	0.164	0.202	21
С	0.788	0.749	5
D	2.97	3.40	14
E	1.14	1.06	7
0	6.90	7.61	10
Р	0.539	0.530	2
F	75.1	158	71
Q	12.1	22.4	60
G	379	793	71
V	1.39	4.80	110
R	0.834	1.08	26
w	6.23	8.98	36
S	1.72	3.04	55
х	11.5	14.4	22
Т	26.3	25.3	4
Υ	20.3	25.6	23
U	144	262	58

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET <u>Labeled Compounds</u>

	Page:	1	_of	1_	
	Reviewer:_		W	<u>G</u>	
2nd	Reviewer:_	(4	-	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Are all labeled compound recoveries within limits?

Y N N/A Are all labeled compound recoveries within limits?
Y N N/A Was the S/N ratio all internal standard peaks ≥ 10?

#	Date	Lab ID/Reference	Labeled Compound	Associated Compound	% Recovery (Limits)	Qualifications
		3 (All dets)	13C12-K	K	160 (26-152)	J/UJ/P
			13C12-L	L	130 (26-123)	J/UJ/P
			13C12-M	М	162 (28-136)	J/UJ/P
			13C12-C	С	155 (32-141)	J/UJ/P
			13C12-D	D	148 (28-130)	J/UJ/P
	1					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

SDG	#: 48680H2a VALIDATI #: 20F0191 ratory: Analytical Resources, Inc.		LETENESS WORKSHEET tage 2B		Date: 68/05/20 Page:of Reviewer:
METH	HOD: GC/MS Semivolatiles (EPA SW 8	46 Method 82	270E)		
	amples listed below were reviewed for tion findings worksheets.	each of the fo	ollowing validation areas. Validation	on findings are	noted in attached
	Validation Area		Comm	nents	Insufficient time to cool
1.	Sample receipt/Technical holding times	SVÝ A	Cooler timps = 15.8%	11.1°C, 18.8°C	time to cool
II.	GC/MS Instrument performance check	T'A'			
III.	Initial calibration/ICV	AIA	1CAL = 20 b	r 10	VE 30%
IV.	Continuing calibration	A	COL 20%		
	Laboratory Blanks	A			
VI.	Field blanks	N			
VII.	Surrogate spikes	A			
VIII.	Matrix spike/Matrix spike duplicates	'A			
IX.	Laboratory control samples	Á	LCS SRM		
X.	Field duplicates	I N	;		
XI.	Internal standards	A			
XII.	Compound quantitation RL/LOQ/LODs	N			
XIII.	Target compound identification	N			
XIV.	System performance	N			
XV.	Overall assessment of data	<u> </u>			
Note:	N = Not provided/applicable R = F	No compounds Rinsate Field blank	detected D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sour OTHER: nk	ce blank
	Client ID		Lab ID	Matrix	Date
1	LDW20-IT334		20F0191-03	Sediment	06/10/20
2	LDW20-SC238B		20F0191-06	Sediment	06/10/20
3	LDW20-SC235B		20F0191-08	Sediment	06/10/20
4	LDW20-SC250B		20F0191-09	Sediment	06/10/20
5	LDW20-IT334MS		20F0191-03MS	Sediment	06/10/20
6	I DW/20-IT334MSD	-	20F0191-03MSD	Sediment	06/10/20

4	LDW20-SC250B	2	0F0191-09	Sediment	06/10/20
5	LDW20-IT334MS	2	0F0191-03MS	Sediment	06/10/20
6	LDW20-IT334MSD	2	0F0191-03MSD	Sediment	06/10/20
7					
8					
9					
Notes					
10163					
-					
ПΤ	BIF0612-Bak1				
ΠT					
ΠT					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
LDW20-IT359MS	20F0191-04MS	Sediment	06/10/20
LDW20-IT359MSD	20F0191-04MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	J (all detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/30/20	Benzoic acid	24.2	LDW20-IT334 LDW20-SC238B	J (all detects) UJ (all non-detects)	А
	Pentachlorophenol	24.8	LDW20-SC235B LDW20-SC250B	J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT359MS/MSD (LDW20-IT359)	N-Nitrosodiphenylamine	-	122 (27-120)	NA	-

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0605-SRM1	Benzo(a)anthracene Chrysene Benzo(a)pyrene	46.3 (50-150) 51.3 (53-147) 36.0 (45-155)	LDW20-IT359 LDW20-IT374	J (all detects) J (all detects) J (all detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	N-Nitrosodiphenylamine	J (all detects)	А	Initial calibration verification (%D)
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-IT359 LDW20-IT374	Benzo(a)anthracene Chrysene Benzo(a)pyrene	J (all detects) J (all detects) J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680H2b SDG #: 20F0191

Stage 2B

Date:_	08/06/20
Page:_)	_of <i>l</i>
Reviewer:	Suc
and Reviewer	

Laboratory: Analytical Resources, Inc.

S V7 A

METHOD: GC/MS Polynuclear Aromatic Hydrocarbens (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	SWIA	Cooler temps = 15.8°C, 11.1°C 18.8°C (Insufficient time to con
<u>II.</u>	GC/MS Instrument performance check	À'	
111.	Initial calibration/ICV	AISW	ICAL = 20% PY ICHE 30%
IV.	Continuing calibration	SW	CON = 206
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	À	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

Client ID	Lab	ID	Matrix	Date
LDW20-IT334	20F0	0191-03	Sediment	06/10/20
LDW20-IT359	20F0	0191-04	Sediment	06/10/20
B 1 LDW20-IT374	20F0	0191-05	Sediment	06/10/20
1 LDW20-SC238B	20F0	0191-06	Sediment	06/10/20
5 LDW20-SC235B	 20F0	0191-08	Sediment	06/10/20
6 2 LDW20-SC250B	20F	0191-09	Sediment	06/10/20
7 LDW20-IT359MS	20F0	0191-04MS	Sediment	06/10/20
B LDW20-IT359MSD	 20F0	0191-04MSD	Sediment	06/10/20
IMS		-03MS		
otesto / MSD		-03MSD		
1 BIFUGOS-BUKI				
2 BIF0612-Bux2				
			<u> </u>	

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

48680H26 LDC #:

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of
Reviewer:_	JVG
2nd Reviewer:_	\mathcal{Q}

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was an initial calibration verification standard analyzed after each ICAL for each instrument? N N/A

Were all %D within the validation criteria of €20/30% %D?

) #	Date	Standard ID	Compound	Finding %D (Limit: <20. 0%(30%)	Associated Samples	Qualifications
	06/26/20	SIF0395-SCVL	Ø.	65.7	1 4-6,9,10 MB2	A/IN/L
-					(ND + Det)	
					· .	
			<u></u>			
					-	

LDC #: 48680 H26

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page: ___of __ Reviewer: __JVG 2nd Reviewer: ___/

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A

YN N/A

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	06/30/20	NT14 200 630035		24.2 24.8		1,4-6,9,10, MB2	ND+Det) J/NJ/A
			TT	24.8			
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LDC #: 48680 A26

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page:_	of
Reviewer:	JУG
2nd Reviewer:	

CV7A METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDC Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD.

Soil / Water.

Was a MS/MSD analyzed every 20 samples of each matrix?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

Ÿ	N)/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?							
#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		9 10	QQ	()	122 (27-120) () (ND)	Jats/A
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LDC #: 48 680 H26

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS) /S RM

Reviewer: JVG 2nd Reviewer:

SUMP METHOD: GC/MS PAH (EPA SW 846 Method 82700-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A N N/A

Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits	s)	LCSD %R (Limits)		RPD (Limits)		Assoc	iated Samples	Qualifications
	BIF0605_SRM1	ccc	46.3 (50	150)	()	()	2,3,	MB1 (DH)	J/UJ/P
		DDD	51.3 (5	3-1471	()	()			1
		III	36.0 (49	5-155	()	()	<i>\</i>	Y	
			()	()	()	•		
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680H3a Stage 2B SDG #: 20F0191 Reviewer: Laboratory: Analytical Resources, Inc. 2nd Reviewer: METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B) The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets. Validation Area Comments Cooler temps = 15.8°C 11.1°C, 18.8°C Sample receipt/Technical holding times GC Instrument Performance Check 11. 100 E 20 B Initial calibration/ICV Ш. IV. Continuing calibration ٧. Laboratory Blanks VI. Field blanks VII. Surrogate spikes VIII. Matrix spike/Matrix spike duplicates

ucs 10

Note:	A = Acceptable	ND = No compounds detected	D = Duplicate	SB=Source blank
	N = Not provided/applicable	R = Rinsate	TB = Trip blank	OTHER:
	SW = See worksheet	FB = Field blank	EB = Equipment blank	

N N

Ν

Client ID	Lab ID	Matrix	Date
LDW20-iT334	20F0191-03	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
es:			

	BI F0609-BUES			
П				

IX.

X.

XI.

XII.

XIII.

Laboratory control samples

Target compound identification

Overall assessment of data

Compound quantitation/RL/LOQ/LODs

Field duplicates

System Performance

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT364	20F0191-01	Sediment	06/10/20
			
LDW20-IT224	20F0191-02	Sediment	06/10/20
LDW20-IT224DL	20F0191-02DL	Sediment	06/10/20
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, 18.8°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0191	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	Α

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	Column	%R (Limits)	Associated Samples	Flag	A or P
BIF0615-SRM1	Aroclor-1260	1C	29.6 (38-167)	All samples in SDG 20F0039	J (all detects)	Р
BIF0615-SRM1	Aroclor-1260	2C	26.6 (38-167)	All samples in SDG 20F0039	J (all detects)	Р

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-IT374	Aroclor-1254	45.2	J (all detects)	А
LDW20-SC238B	Aroclor-1260	40.3	J (all detects)	А
LDW20-IT228	Aroclor-1248	40.7	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-IT224	Aroclor-1248 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT224DL	All compounds except Aroclor-1248 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, SRM %R, and RPD between two columns, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT364 LDW20-IT334 LDW20-IT359 LDW20-IT374 LDW20-SC238B LDW20-IT228 LDW20-SC235B LDW20-SC250B LDW20-SC250B LDW20-IT244	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-IT224	Aroclor-1260	J (all detects)	Α	Initial calibration verification (%D)
LDW20-IT224DL	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	Α	Initial calibration verification (%D)
LDW20-IT364 LDW20-IT224 LDW20-IT334 LDW20-IT379 LDW20-IT374 LDW20-SC238B LDW20-IT228 LDW20-SC235B LDW20-SC250B LDW20-SC250B LDW20-IT244	Aroclor-1260	J (all detects)	P	Standard reference materials (%R)
LDW20-IT374	Aroclor-1254	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC238B	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-IT228	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT224	Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT224DL	All compounds except Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data

Duwamish AOC4 Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680H3b Stage 28 L SDG #: 20F0191 Laboratory: Analytical Resources, Inc.

Page: \ of) Reviewer: 2nd Reviewer

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	<i></i>
ı.	Sample receipt/Technical holding times	SW/ A	cooler temps = 15.8°C, 11.1°C	18.8°C (Insuffici time to W = 202
11.	Initial calibration/ICV	A ISW		105 30g
Ш.	Continuing calibration	À	CW = 20%	
IV.	Laboratory Blanks	A'		
V.	Field blanks	4		
VI.	Surrogate spikes / 15	A/A		
VII.	Matrix spike/Matrix spike duplicates	' A	<u> </u>	
VIII.	Laboratory control samples	SW	LCS SRM	
IX.	Field duplicates	7	*	
X.	Compound quantitation/RL/LOQ/LODs	SW		
XI.	Target compound identification	N		
XIL	Overall assessment of data	SN		

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT364	20F0191-01	Sediment	06/10/20
2	LDW20-IT224	20F0191-02	Sediment	06/10/20
3	LDW20-IT224RE D	20F0191-02RE DL	Sediment	06/10/20
4	LDW20-IT334	20F0191-03	Sediment	06/10/20
5	LDW20-IT359	20F0191-04	Sediment	06/10/20
6	LDW20-IT374	20F0191-05	Sediment	06/10/20
7	LDW20-SC238B	20F0191-06	Sediment	06/10/20
8	LDW20-IT228	20F0191-07	Sediment	06/10/20
9	LDW20-SC235B	20F0191-08	Sediment	06/10/20
10_	LDW20-SC250B	20F0191-09	Sediment	06/10/20
11_	LDW20-IT244	20F0191-10	Sediment	06/10/20
12_	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
13	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
14				
15_				
<u>_</u> 16	\$1 F06/5-BULL			
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	тт.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	vv
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:		

LDC#: 48680 H36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	1 _of]
Reviewer:_	JVG
2nd Reviewer:	4

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". What type of initial calibration verification calculation was performed? / %D or ____%R

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

	7		Detector		8/ D	
Y(N	N/N/A	Did the initial calibra	ation verification sta	andards meet the %D .	/ %R validation criteri	a of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SC	V1 2C	BB	21.0	All (Det 7 MD)	J/UJ/A (gual Z, AA, BB)
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LDC #: 48 680 H3b

VALIDATION FINDINGS WORKSHEET $\underline{\textbf{Laboratory Control Samples}} \; / \; \textit{SRM}$

Reviewer: 2nd Reviewer:_

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y N N/A Y(N) N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

) #	LCS/LCSD ID	Compound (Col) %F	LCS R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIPOGIS- SRM1	BB (140) 29	.6(38-167)	()		All (Det)	J/UJ/P
		·/ (2c) 26.	.6 (38-167)	()	()		1 ' 1
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VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page:	of
Reviewer: _	JXG
2nd Reviewer:	
	- V

LDC #: 48680 H 9b

METHOD: GC _ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

₩N N/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

N/A UK Y/ N) N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPDI%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	AA	6	45.2	J dets A
	ВВ	7	40.3	
	Z	g	40.7	,
		D	10./	у
 				
		(* - e ¹		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680 H3b

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page:	of	
Reviewer:	J X G	
2nd Reviewer:		

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

YN N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated sample	Qualifications
	Z, AA	> cal range	2	NR/A
	All except about	di	3	<i>y</i>
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Comments:				
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

O a manufactura di Sia a di a m	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-IT364	20F0191-01	Sediment	06/10/20
LDW20-IT224	20F0191-02	Sediment	06/10/20
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
LDW20-IT334DUP	20F0191-03DUP	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Silver	0.033 ug/L	LDW20-IT334
ICB/CCB	Silver	0.018 ug/L	LDW20-SC238B LDW20-SC235B LDW20-SC250B

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration		
LDW20-IT334	Silver	0.21 mg/Kg	0.21U mg/Kg		

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SC238B	Silver	0.2 mg/Kg	0.2U mg/Kg
LDW20-SC235B	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SC250B	Silver	0.2 mg/Kg	0.2U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	A
LDW20-IT334MS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Mercury	-	127 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Silver	23 (≤20)	J (all detects)	А

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD, data were qualified as estimated in four samples.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0191

Sample	Analyte	Flag	A or P	Reason
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Silver	J (all detects)	А	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0191

Sample	Analyte	Modified Final Concentration	A or P
LDW20-IT334	Silver	0.21U mg/Kg	А
LDW20-SC238B	Silver	0.2U mg/Kg	А
LDW20-SC235B	Silver	0.17U mg/Kg	Α
LDW20-SC250B	Silver	0.2U mg/Kg	A

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

LDC #: 48680H4a SDG #: 20F0191

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

Date: 7/30/20

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
<u>l.</u>	Sample receipt/Technical holding times	A/A	
Н.	ICP/MS Tune	Α	
III.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	Α	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	(11,12), From SDG # 20F0186 (LDW20-IT379FD MS/MSD)
VIII.	Duplicate sample analysis	Α	13, From SDG # 20F0186 (LDW20-IT379FD MS/MSD)
iX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT364	20F0191-01	Sediment	06/10/20
2	LDW20-IT224	20F0191-02	Sediment	06/10/20
3	LDW20-IT334	20F0191-03	Sediment	06/10/20
4	LDW20-IT359	20F0191-04	Sediment	06/10/20
5	LDW20-IT374	20F0191-05	Sediment	06/10/20
6	LDW20-SC238B	20F0191-06	Sediment	06/10/20
7	LDW20-IT228	20F0191-07	Sediment	06/10/20
3	LDW20-SC235B	20F0191-08	Sediment	06/10/20
9	LDW20-SC250B	20F0191-09	Sediment	06/10/20
10_	LDW20-IT244	20F0191-10	Sediment	06/10/20
11_	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
12	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
13_	LDW20-IT334DUP	20F0191-03DUP	Sediment	06/10/20
4				

Notes:

LDC #: 48680H4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
3,6,8,9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,2,4,5,7,10	As
QC	
11,12,13	Hg
	Analysis Method
ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEET Laboratory Blank Contamination (PB/ICB/CCB)

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 3

			Samı	Sample Identification							
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	3							
Ag		0.033		0.21							

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: 6,8,9

<u>-</u>	-	····		Sample Identification								
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	6	8	9						
Ag		0.018		0.2	0.17	0.2						
			,									

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
LDW20-IT379FD	S	Ag	34.1		75-125			3,6,8,9	J/UJ/A	Det
		Ag				23		3,6,8,9	J/UJ/A	Det
11 &12	S	Hg		127	75-125			3,6,8,9	Jdet/A	Det
						-				
							<u> </u>		 	
				-			 			
<u> </u>										

Comments:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

	Laboratory Sample		Collection		
Sample Identification	Identification	Matrix	Date		
LDW20-IT364	20F0191-01	Sediment	06/10/20		
LDW20-IT224	20F0191-02	Sediment	06/10/20		
LDW20-IT334	20F0191-03	Sediment	06/10/20		
LDW20-IT359	20F0191-04	Sediment	06/10/20		
LDW20-IT374	20F0191-05	Sediment	06/10/20		
LDW20-SC238B	20F0191-06	Sediment	06/10/20		
LDW20-IT228	20F0191-07	Sediment	06/10/20		
LDW20-SC235B	20F0191-08	Sediment	06/10/20		
LDW20-SC250B	20F0191-09	Sediment	06/10/20		
LDW20-IT244	20F0191-10	Sediment	06/10/20		
LDW20-IT228MS	20F0191-07MS	Sediment	06/10/20		
LDW20-IT228DUP	20F0191-07DUP	Sediment	06/10/20		

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

LDC #: 48680H6 SDG #: 20F0191

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 7/30/20 Page: 1 of 1 Reviewer: 471 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
11	Initial calibration	А	
III.	Calibration verification	Α	
IV	Laboratory Blanks	Α	
٧	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	А	11
VII.	Duplicate sample analysis	А	12, From SDG # 20F0157 (LDW20-SC148C DUP)
VIII.	Laboratory control samples	А	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	А	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank

OTHER:

SB=Source blank

Lab ID **Client ID** Matrix Date LDW20-IT364 20F0191-01 Sediment 06/10/20 2 LDW20-IT224 20F0191-02 Sediment 06/10/20 3 LDW20-IT334 20F0191-03 Sediment 06/10/20 LDW20-IT359 20F0191-04 Sediment 06/10/20 5 20F0191-05 LDW20-IT374 Sediment 06/10/20 6 LDW20-SC238B 20F0191-06 Sediment 06/10/20 LDW20-IT228 20F0191-07 Sediment 06/10/20 8 LDW20-SC235B 20F0191-08 Sediment 06/10/20 LDW20-SC250B Sediment 06/10/20 9 20F0191-09 10 LDW20-IT244 20F0191-10 Sediment 06/10/20 11 LDW20-IT228MS 20F0191-07MS Sediment 06/10/20 LDW20-IT228DUP 20F0191-07DUP Sediment 12 06/10/20 13 14

Notes:	 					
_						

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 10	TS, TOC	
		_
QC		
11,12	TOC	
		_

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Polychlorinated Dioxins/Dibenzofurans

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT359DUP	20F0191-04DUP	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 11.1°C, 15.8°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0191

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT359DUP (LDW20-IT359)	OCDF	39.0 (≤25)	J (all detects)	А

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0191	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to DUP RPD and compounds reported as EMPC, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT359	OCDF	J (all detects)	А	Duplicate sample analysis (RPD)
LDW20-IT359 LDW20-IT374 LDW20-IT228 LDW20-IT244	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

. 50	" 40000U04 VALIDATIO	N COME	DI ETEMBO	e WODKEHEET	D	-t-: 00/07/00
				WORKSHEET		ate: <u>08/07/20</u>
	#:20F0191 ratory: Analytical Resources, Inc.	•	Stage 4			Page: <u>1</u> of <u>1</u> ewer: JVG
Labor	atory. Analytical Nesources, inc.		2nd Revi			
METI	HOD: HRGC/HRMS Polychlorinated Dioxi	ins/Dibenz	ofurans (EPA	Method 1613B)		
	samples listed below were reviewed for ea ation findings worksheets.	ich of the fo	ollowing valida	tion areas. Validation	findings are note	ed in attached
<u> </u>	Validation Area	<u> </u>		Comme	nts	
1.	Sample receipt/Technical holding times	SW/A	Cooler temp = 1	5.8, 11.1, 18.8 deg C	(Insufficier	nt time to cool)
II.	HRGC/HRMS Instrument performance check	A				
111.	Initial calibration/ICV	A/A	ICAL ≤ 2	20/35%	ICV ≤ QC L	_imits
IV.	Continuing calibration	Α	CCV ≤ (QC Limits		
V.	Laboratory Blanks	sw				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates/LD	N/SW	L			
VIII.	Laboratory control samples	A	OPR,	SRM		
IX.	Field duplicates	N				
X.	Labeled Compounds	Α				
XI.	Compound quantitation RL/LOQ/LODs	Α	EMPC	= Jdets/A		
XII.	Target compound identification	A	<u></u>			
XIII.	System performance	A	<u> </u>			
XIV.	Overall assessment of data	A				
Note:	N = Not provided/applicable R = Rin	lo compounds nsate ield blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source b OTHER:	lank
	Client ID			Lab ID	Matrix	Date
1	LDW20-IT359			20F0191-04	Sediment	06/10/20
2	LDW20-IT374			20F0191-05	Sediment	06/10/20
3	LDW20-IT228			20F0191-07	Sediment	06/10/20
4	LDW20-IT244			20F0191-10	Sediment	06/10/20
5	LDW20-IT359DUP			20F0191-04DUP	Sediment	06/10/20
6						

9				
Notes	3:			
	BFI0780-BLK1			

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: JVG
2nd Reviewer:

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times			•	
All technical holding times were met.	✓			
Cooler temperature criteria was met.		√_		
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	√			
Were the retention time windows established for all homologues?	√			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	√			
Was the mass resolution adequately check with PFK?	√			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?				
Illa. Initial calibration			_	
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled compounds and \leq 35% for unlabeled compounds?	√			
Did all calibration standards meet the Ion Abundance Ratio criteria?	√			
Was the signal to noise ratio for each target compound and labeled compound \geq 10?	√			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	√			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	√			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	√ _			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	√			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	√			
V. Blanks				
Was a method blank associated with every sample in this SDG?	√			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	√			
Was there contamination in the method blanks?	√			
VI. Field blanks				
Were field blanks identified in this SDG?		√		
Were target compounds detected in the field blanks?			√	<u> </u>
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		√		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			√	

VALIDATION FINDINGS CHECKLIST

Page: 1_of_2 Reviewer: __JV6 2nd Reviewer: ____

	\ <u></u>			F1-11
Validation Area VIII. Laboratory control samples	Yes	No	NA	Findings/Comments
Was an LCS analyzed per extraction batch?	√			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within				
the QC limits?	<u> </u>			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		√		
Were target compounds detected in the field duplicates?			√	
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	√_			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	√			· · · · · · · · · · · · · · · · · · ·
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	√			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	√			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	√			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	√			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	√			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	√			
Did compound spectra contain all characteristic ions listed in the table attached?	√			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	√			
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?	√			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?	√			
Was an acceptable lock mass recorded and monitored?	√			
XIII. System performance				
System performance was found to be acceptable.	√			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	√_			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:			

VALIDATION FINDINGS WORKSHEET Blanks

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Reviewer:	JVG
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METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- $\frac{Y}{Y}$ Were all samples associated with a method blank?
- Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Was the method blank contaminated?

Blank extraction date: 06/29/20 Blank analysis date: 07/02/20 Associated samples: All (>5X) Conc. units: ng/Kg

Compound	Blank ID		Sample Identification							
100 March 1997	BIF0780-BLK1	(5x)								
0	0.0726*	0.36								
F	0.220*	1.10								
Q	0.477*	2.39								
G	1.66	8.30								

*EMPC

VALIDATION FINDINGS WORKSHEET Duplicate Analysis

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METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a duplicate sample analyzed for each matrix in this SDG? <u>Y</u> <u>N</u>

Were all duplicate sample relative percent differences (RPD) < 25?

#	Duplicate ID	Compound	RPD (L	_imits)	Associated Samples	Qualifications
	5	Q	39.0	(≤25%)	1 (Det)	Jdets/A
				(≤		
				(<		
				(≤)		
				(<		
				(≤)		
		ļ	↓	(<)		
			<u> </u>	(≤		
				(≤		······································
			ļ	(≤)		
		ļ	<u> </u>	(≤)		
			<u> </u>	(<		
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Comments:		 	 	 	

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

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METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

					Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
ll .		Calibration			RRF	RRF	Average RRF	Average RRF	%RSD	%RSD
#	Standard ID	Date	Com	pound (IS)			(Initial)	(Initial)		
1	ICAL	7/1/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
	Autospec01		2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
1			1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
			OCDD	(13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

VALIDATION FINDINGS WORKSHEET Continuing Calibration Calculation Verification

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

Where:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

Ax = Area of compound,

Cx = Concentration of compound,

Ais = Area of associated internal standard

Cis = Concentration of internal standard

		Calibration			Average RRF	Reported RRF	Recalculated RRF	Reported % D	Recalculated %D
#	Standard ID	Date	Compou	ınd (Ref IS)	(Initial)	(CCV)	(CCV)		
1	20070202	7/2/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8223	0.8060	0.8060	2.0	2.0
	Autospec01		2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2310	1.2380	1.2380	0.6	0.6
			1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9154	0.9359	0.9359	2.2	2.2
			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1246	1.1394	1.1394	1.3	1.3
			OCDD	(13C-OCDD)	1.2095	1.1641	1.1641	3.8	3.8

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

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nd F	?eviewer:_		

METHOD: GC/MS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration

SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

	Sı	oike	Spiked Sample		LCS		LCSD		LCS/I	LCSD	
Compound		Added (ng/Kg)		Concentration (ng/Kg)		Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.	
2,3,7,8-TCDD	20		19.97		99.9	99.9					
1,2,3,7,8-PeCDD	100		101.79		102	102					
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3					
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105					
OCDF	200		182.39		91.2	91.2					

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B)

- Y
 Y
 Were all reported results recalculated and verified for all level IV samples?
 Y
 Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concen	tration	$= \frac{(A_{s})(I_{s})(DF)}{(A_{ts})(RRF)(V_{o})(\%S)}$	Example:				
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D. 1 OCDD				
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard					
l _s	=	Amount of internal standard added in nanograms (ng)	Conc. = $(1.037e6+1.171e6)(200)(20uL)$ (3.537e5+3.825e5)(1.2095)(17.24g)(0.583)				
V_{o}	=	Volume or weight of sample extract in milliliters (ml) or grams (g).					
RRF	=	Relative Response Factor (average) from the initial calibration	= 986.85				
Df	=	Dilution Factor.	= 987 ng/Kg				
%S	=	Percent solids, applicable to soil and solid matrices only.					

#	Sample ID	Compound	Reported Concentration (ng/Kg)	Calculated Concentration (ng/Kg)	Acceptable (Y/N)
	1	OCDD	987	987	-
-					
			-		
				1	
 					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS135MS	20F0194-13MS	Sediment	06/10/20
LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0662-SRM1	Acenaphthylene Anthracene	51.7 (52-148) 54.7 (57-143)	All samples in SDG 20F0194	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SS338	LDW20-SS338-FD	RPD
2-Methylnaphthalene	10.2	10.2	0
Fluorene	20.0U	10.6	Not calculable
Phenanthrene	69.3	77.2	11
Anthracene	19.8	21.1	6
Fluoranthene	156	153	2
Pyrene	146	137	6

	Concentra		
Compound	LDW20-SS338	LDW20-SS338-FD	RPD
Butylbenzylphthalate	18.3	21.8	17
Benzo(a)anthracene	58.0	63.6	9
Chrysene	117	115	2
Bis(2-ethylhexyl)phthalate	230	202	13
Benzofluoranthenes, total	180	170	6
Benzo(a)pyrene	67.4	63.7	6
Indeno(1,2,3-cd)pyrene	49.9	47.8	4
Dibenzo(a,h)anthracene	18.1	14.1	25
Benzo(g,h,i)perylene	62.6	58.9	6

	Concentra		
Compound	LDW20-SS123	LDW20-SS123-FD	RPD
Phenanthrene	38.5	38.0	1
Anthracene	12.7	13.9	9
Fluoranthene	91.4	92.3	1
Pyrene	89.7	91.2	2
Butylbenzylphthalate	11.1	20.0U	Not calculable
Benzo(a)anthracene	39.7	38.8	2
Chrysene	66.0	61.4	7
Bis(2-ethylhexyl)phthalate	86.8	118	30
Benzofluoranthenes, total	109	112	3
Benzo(a)pyrene	42.1	42.9	2
Indeno(1,2,3-cd)pyrene	29.8	3.5	158

	Concentration (ug/Kg)		
Compound	LDW20-SS123	LDW20-SS123-FD	RPD
Dibenzo(a,h)anthracene	11.1	20.0U	Not calculable
Benzo(g,h,i)perylene	37.0	36.5	1

	Concentra		
Compound	LDW20-SS130	LDW20-SS130-FD	RPD
Phenanthrene	30.6	30.1	2
Anthracene	10.4	10.5	1
Fluoranthene	60.3	501	157
Pyrene	81.4	65.7	21
Butylbenzylphthalate	19.9U	10.4	Not calculable
Benzo(a)anthracene	28.3	25.0	12
Chrysene	45.9	65.8	36
Bis(2-ethylhexyl)phthalate	66.8	61.0	9
Benzofluoranthenes, total	85.8	71.1	19
Benzo(a)pyrene	34.8	27.6	23
Indeno(1,2,3-cd)pyrene	24.0	19.9	19
Benzo(g,h,i)perylene	25.6	25.8	1

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS36 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130-FD LDW20-SS130-FD LDW20-SS135	Acenaphthylene Anthracene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 4868012a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0194 Laboratory: Analytical Resources, Inc. Stage 4

Date: 68/05/20
Page: 1 of 4
Reviewer: 14
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments (Insufficient
l.	Sample receipt/Technical holding times	SWIA	Coster temps = 13.6°C 15.6°C 20,1°C time to con
II.	GC/MS Instrument performance check	A	le
111.	Initial calibration/ICV	ASA	A 10AL = 20% N WE 30%
IV.	Continuing calibration	A	COV & 20/0
V.	Laboratory Blanks	/A	
VI.	Field blanks	l H	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SA	LCS , SRM
X.	Field duplicates	SW	D=3/4 8/9 11/12
XI.	Internal standards	A	,
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet R

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

Client ID Lab ID Matrix Date LDW20-SS356 20F0194-01 Sediment 06/10/20 20F0194-02 Sediment 06/10/20 LDW20-SS364 LDW20-SS338 20F0194-03 Sediment 06/10/20 D, LDW20-SS338-FD 20F0194-04 Sediment 06/10/20 LDW20-SS336 20F0194-05 Sediment 06/10/20 5 LDW20-SS106 20F0194-06 Sediment 06/10/20 LDW20-SS121 20F0194-07 Sediment 06/10/20 Dr LDW20-SS123 20F0194-08 Sediment 06/10/20 17 LDW20-SS123-FD 20F0194-09 Sediment 06/10/20 10 LDW20-SS125 20F0194-10 Sediment 06/10/20 20F0194-11 11 LDW20-SS130 Sediment 06/10/20 D3 LDW20-SS130-FD 20F0194-12 Sediment 06/10/20 12 13 LDW20-SS135 20F0194-13 Sediment 06/10/20 20F0194-13MS 06/10/20 LDW20-SS135MS Sediment

LDC #: 48680I2a VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0194 Stage 4 Laboratory: Analytical Resources, Inc. METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)						Date: 08/05/20 Page: 2 of 2 eviewer: 3/4 eviewer: 4
15	LDW20-SS135MSD			20F0194-13MSD	Sediment	06/10/20
16						
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18				<u></u>		
Notes	<u>:</u>					
	BIF0662-BLK1					
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VALIDATION FINDINGS CHECKLIST

Page: 1_of_2 Reviewer: __JVG 2nd Reviewer: ____

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Method: Semivolatiles (EPA SW 846 Method 8270)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times		/		
Were all technical holding times met?				
Was cooler temperature criteria met?		/		
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?		·		
Were all samples analyzed within the 12 hour clock criteria?				
Illa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?				
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) within method criteria?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of \geq 0.990?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/		,	
Were all percent differences (%D) <u>≤</u> 30%?				
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?				
Were all percent differences (%D) \leq 20% and relative response factors (RRF) within method criteria?		,		
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?				
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.				
VI. Field blanks				
Were field blanks were identified in this SDG?				
Were target compounds detected in the field blanks?				
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?				
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?				
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R?				/
VIII. Matrix spike/Matrix spike duplicates		/		
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG2		1	I	

VALIDATION FINDINGS CHECKLIST

Page: 2_of_2 Reviewer: JVG 2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/	110	NA .	r mungsroomments
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?				
Were retention times within ± 30 seconds of the associated calibration standard?				
XII. Compound quantitation	,			
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				
Were chromatogram peaks verified and accounted for?				
XIV. System performance	·			
System performance was found to be acceptable.				
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachiorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzof Inoranthenes, Total

LDC #: 48680 [2a

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> / SRM

Page:	<u></u> _of	<u>1</u>
Reviewer:	_J\(G	
2nd Reviewer:		

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID BI FO GG2-SRM1	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIFOGGZ-SRM1	Pb	51.7 (52.148)	()	()	All (ND+Det)	J/45/P
		٧٧	54.7 (57-143)	()	()		
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LDC#: 48680l2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1/2 Reviewer: JVG 2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)
YNNA Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentra		
Compound	3	4	RPD
w	10.2	10.2	0
NN	20.0U	10.6	NC
υυ	69.3	77.2	11
w	19.8	21.1	6
YY	156	153	2
ZZ	146	137	6
AAA	18.3	21.8	17
ccc	58.0	63.6	9
DDD	117	115	2
EEE	230	202	13
A2	180	170	6
Ш	67.4	63.7	6
1111	49.9	47.8	4
ккк	18.1	14.1	25
LLL	62.6	58.9	6

	Concentra		
Compound	8	9	RPD
UU	38.5	38.0	1
w	12.7	13.9	9
YY	91.4	92.3	1
ZZ	89.7	91.2	2
AAA	11.1	20.0U	NC
ccc	39.7	38.8	2
DDD	66.0	61.4	7
EEE	8.38	118	30
A2	109	112	3
=	42.1	42.9	2
111	29.8	3.5	158
ккк	11.1	20.0U	NC
LLL	37,0	36.5	1

	Concentrat		
Compound	11	12	RPD
UU	30.6	30.1	2
w	10.4	10.5	1
YY	60.3	501	157

LDC#: 48680I2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_2_of_2_ Reviewer:_JVG 2nd Reviewer:_

METHOD: GC MS SVOA (EPA SW 846 Method 8270E)
Y N NA
Were field duplicate pairs identified in this SDG?

YNNA Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	11	12	RPD
ZZ	81.4	65.7	21
AAA	19.9U	10.4	NC
ccc	28.3	25.0	12
DDD	45.9	65.8	36
EEE	66.8	61.0	9
A2	85.8	71.1	19
Ш	34.8	27.6	23
111	24.0	19.9	19
LLL	25.6	25.8	1

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LDC #: 4868012a

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:_	_ <u>1_</u> of_1_	
Reviewer:	JХС	
2nd Reviewer: _	4	

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

					Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
		Calibration			RRF	RRF	Average RRF	Average RRF	%RSD	%RSD
#	Standard ID	Date	Compoun	ıd (IS)	(RRF 10 std)	(RRF 10 std)	(Initial)	(Initial)		
1	ICAL	06/26/20	Phenol	(DCB)	1.56542	1.56542	1.51555	1.51555	6.8	6.8
			Naphthalene	(NPT)	1.02917	1.02917	0.98495	0.98495	4.3	4.3
	NT10		Fluorene	(ANT)	1.74545	1.74545	1.53228	1.53228	9.1	9.1
			Phenanthrene	(PHN)	1.09634	1.09634	1.07498	1.07498	3.3	3.3
			Fluoranthene	(CRY)	1.79823	1.79823	1.73035	1.73035	6.4	6.4
	1		BEHP	(DNOP)	0.51752	0.51752	0.48659	0.48659	4.2	4.2
			Benzo(g,h,i)peryle	ene (PRY)	1.28998	1.28998	1.23261	1.23261	4.9	4.9

LDC # <u>48680I2a</u>

VALIDATION FINDINGS WORSHEET Continuing Calibration Calculation Verification

Page:_	<u>1 of 1 </u>
Reviewer:	√ CG
2nd Reviewer:	4

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

Ax = Area of compound,

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

Where:

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

Cx = Concentration of compound,

Ais = Area of associated internal standard

Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compoun	d (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062902	6/29/2020	Phenol	(DCB)	1.51555	1.61191	1.61191	6.4	6.4
			Naphthalene	(NPT)	0.98495	1.01749	1.01749	3.3	3.3
	NT10		Fluorene	(ANT)	1.53228	1.70139	1.70139	11.0	11.0
			Phenanthrene	(PHN)	1.07498	1.09561	1.09561	1.9	1.9
			Fluoranthene	(CRY)	1.73035	1.81567	1.81567	4.9	4.9
			BEHP	(DNOP)	0.48659	0.50856	0.50856	4.5	4.5
			Benzo(g,h,i)peryle	ene (PRY)	1.23261	1.22650	1.22650	0.5	0.5

LDC#:_ 48680 IZA

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:_	<u>1_of_1_</u>
Reviewer:	JVG
2nd reviewer:	4

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	5.00	3.732	66.6	66.6	0
2-Fluorobiphenyl		3.594	71-9	71.9	
Terphenyl-d14		3.650	73.0	73.0	
Phenol-d5	7.50	4.567	60.9	60.9	
2-Fluorophenol		4.603	61.4	61.4	
2,4,6-Tribromophenol		5.912	78.8	78-5	
2-Chlorophenol-d4	,	5.081	67.7	67.7	
1,2-Dichlorobenzene-d4	5,00	3.746	64.9	64.9	<i>X</i>

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #:_ 48680 I2a

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: _____\4 //\$

Compound	Spike Added (Wo /kg)				Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD		
	MS	MSD		MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	500	500	υ	438	925	87,0	87-6	85.1	85.0	2,93	3.01
N-N itrose-di-n-propylami ne				•							
4-Chloro-3-methylphenol											
Acenaphthene	500	200	0	428	421	85.7	85.6	84.2	84.2	1.76	1.65
Pe <u>ntachlorophen</u> ol									7.0 LAL		
Pyrene	500	50	39.8	480	468	88.1	88.0	85.7	85.6	2,46	7,53

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within
0.0% of the recalculated results.

LDC#:_ 4868 I 2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

	Page:_	<u>1_of_1_</u>	
	Reviewer:_	JVG	
2nd	Reviewer:_	d	

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration

SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BI+0662-BS1

Compound	Ad	oike Ided	Conce	Spike Concentration (VG/ke)		LCS Percent Recovery		I CSD Percent Recovery		I CSD
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	500	NA	433	NA	86.5	86.6				
N-Nitroso-di-n-propylamine				(
4-Chier 6-3-meth ylphenol										
Acenaphthene	500		427		84.4	84.4				
Pentaehlorophen ol										
Pyrene	500	\ \X	474	}	94.7	94.8				
						,				

Comments: _	Refer to	<u>o Laborato</u>	ry Control	Sample/L	aboratory	Control	Sample	Duplicates	findings	worksheet	for list	of qualif	ications and	l associated	samples	s when
reported resu	ults do r	not agree v	ithin 10.0°	% of the re	calculated	d results										

LDC#: 48680 I1a

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1_of_1_	
Reviewer:	JVG	
2nd reviewer:	4	

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

\bigcirc	N	N/A
Y	N	N/A

Were all reported results recalculated and verified for all level IV samples?
Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concer	ıtratioı	$\begin{array}{ll} n = & (\underline{A_s})(\underline{I_s})(\underline{V_t})(\underline{DF})(\underline{2.0}) \\ & (A_{ts})(RRF)(\underline{V_o})(\underline{V_i})(\%S) \end{array}$
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
l _s	=	Amount of internal standard added in nanograms (ng)
V_{\circ}	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_{i}	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:
Sample I.D. # 2 ,
Conc. = (1974332) (4.0) (INL) (1000) ((45954) (1.730346) (25) 989) (0.385)
= 1159.5
= 1160 ug/kg

#	Sample ID	Compound	Reported Concentration (Ug	Calculated Concentration (りた)	Qualification
	2	YY	1160	1160	

<u> </u>					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 7, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS135MS	20F0194-13MS	Sediment	06/10/20
LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0194	UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0662-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene	32.0 (34-166) 29.8 (36-164)	All samples in SDG 20F0039	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (ug/Kg)		
Compound	LDW20-SS338	LDW20-SS338-FD	RPD
Benzyl alcohol	25.4	34.2	30

	Concentra	tion (ug/Kg)	
Compound	LDW20-SS338	LDW20-SS338-FD	RPD
Benzoic acid	58.9	51.5	13
Pentachlorophenol	2.4	2.6	8

	Concentra	tion (ug/Kg)	
Compound	LDW20-SS123	LDW20-SS123-FD	RPD
1,4-Dichlorobenzene	17.7	5.0U	Not calculable
Benzyl alcohol	9.3	7.3	24

	Concentra		
Compound	LDW20-SS130	LDW20-SS130-FD	RPD
1,4-Dichlorobenzene	1.9	1.7	11
Benzyl alcohol	4.7	20.0U	Not calculable

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and SRM %R, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS366 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS130-FD LDW20-SS135	1,4-Dichlorobenzene 1,2-Dichlorobenzene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 4868012b SDG #: 20F0194

Stage 4

Date: 08/06/20 Reviewer: 2nd Reviewer:

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Pelynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	SWIA	Cooler temps = 13.6°C 15.6°C 20.1°C time to a
И.	GC/MS Instrument performance check	A	
111.	Initial calibration/ICV	A ISW	1CAL = 20% PT 100 30 2
IV.	Continuing calibration	A	1CAV = 20% Y7 100 30? COV = 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	Á	
IX.	Laboratory control samples	SW	LCS SRM
X.	Field duplicates	SW	$D = \frac{3}{4} = \frac{8}{9} = \frac{11}{12}$
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Ä	
XIII.	Target compound identification	A	
XIV.	System performance	À	
XV.	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Labin	Matri	D.4
	Client ID	Lab ID	Matrix	Date
1	LDW20-SS356	20F0194-01	Sediment	06/10/20
2	LDW20-SS364	20F0194-02	Sediment	06/10/20
3	LDW20-SS338 D,	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD \mathcal{D}_t	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
6	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130 23	20F0194-11	Sediment	06/10/20
12_	LDW20-SS130-FD D 3	20F0194-12	Sediment	06/10/20
13_	LDW20-SS135	20F0194-13	Sediment	06/10/20
14_	LDW20-SS135MS	20F0194-13MS	Sediment	06/10/20

SDG #: 20F0194 Stage 4 Laboratory: Analytical Resources, Inc.			Stage 4	S WORKSHEET	Date: <u>08(0</u> Page: <u>2</u> _of Reviewer:_ ∑		
MET	HOD: GC/MS Polynuclea	ır Aromatic Hydroca	arbons (EPA SW 846	Method 8270E-SIM)	2nd R	eviewer:	
15	LDW20-SS135MSD			20F0194-13MSD	Sediment	06/10/20	
16					 		
17							
18 Notes	:						
	BIF0662-BU2						
-				···			

LDC	#:	48	6	80	+	2	Ŀ

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: JVG
2nd Reviewer:

Method: Semivolatiles (EPA SW 846 Method 8270¢-SIM)

Method: Semivolatiles (EPA SW 846 Method 8270₡-SIM)							
Validation Area	Yes	No	NA		Findin	gs/Comm	ents
I. Technical holding times							
Were all technical holding times met?	/						
Was cooler temperature criteria met?	<u> </u>						
II. GC/MS Instrument performance check (Not required)							
Were the DFTPP performance results reviewed and found to be within the specified criteria?							
Were all samples analyzed within the 12 hour clock criteria?	/						
Illa. Initial calibration					, <u>.</u>		
Did the laboratory perform a 5 point calibration prior to sample analysis?							
Were all percent relative standard deviations (%RSD) \leq 15% and relative response factors (RRF) \geq 0.05?							
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of \geq 0.990?							
IIIb. Initial Calibration Verification							
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?							
Were all percent differences (%D) ≤20%?							
IV. Continuing calibration							
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?							
Were all percent differences (%D) \leq 20% and relative response factors (RRF) \geq 0.05?							
V. Laboratory Blanks	,						
Was a laboratory blank associated with every sample in this SDG?						·	
Was a laboratory blank analyzed for each matrix and concentration?							
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.							
VI. Field blanks			, -				
Were field blanks identified in this SDG?		1					
Were target compounds detected in the field blanks?							
VII. Surrogate spikes							
Were all surrogate percent differences (%R) within QC limits?							
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?				,			
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?							· · · · · · · · · · · · · · · · · · ·

LDC #: 48680 I 26

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: JVG
2nd Reviewer: _____

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates		<u> </u>		
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
IX. Laboratory control samples				
Was an LCS analyzed per analytical batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		•		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards	,			
Were internal standard area counts within -50% or +100% of the associated calibration standard?				
Were retention times within <u>+</u> 30 seconds of the associated calibration standard?				
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	/			m _k ,
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?		-		
XIII. Target compound identification				
Were relative retention times (RRT's) within \pm 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				
Were chromatogram peaks verified and accounted for?				
XIV. System performance				
System performance was found to be acceptable.				
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o"-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #:	48680	I26

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>_</u> of	1
Reviewer:_	JVJG	
2nd Reviewer:	<u>a</u>	

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Y N N/A

Were all %D within the validation criteria of \$20/30% %D?

Was an initial calibration verification standard analyzed after each ICAL for each instrument? Were all %D within the validation criteria of \$\frac{20\fmathcal{2}}{20\fmathcal{2}} \% \% D ?

-	<u>)N/A</u> W	ere all 700 within the valid	ation criteria of ≤20/ 30% %D			T
#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%/30%)	Associated Samples	Qualifications
	06/26/20	SIF6393-SCV	1 00	41.9	AII (ND)	J/UJ/X
		•			(-1)	
-						

LDC #: 48680 126

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u> (SRM)

Page:	_ <u>_</u> _of
Reviewer:	JVG
2nd Reviewer:	4

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

YN N/A Was a LCS required?

V/N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)		LCSD %R (Limits)		RPD (Limits)		Associated Samples	Qualifications
	BIF6662-SKM2	Ш	32,0 (3	4-166)	()		()	All (ND+Det)	J/UJ/P
		F	29.8 (2	6-164)	()		()		V
			()	()		()	•	
			()	()		()		
			()	()		()		
			()	()		()		
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			()	()	_	()		
			()	(<u> </u>	()		
			()	()	<u> </u>	()		
			()	()	+	()		
			()	()	+	()		
			()	()	+	()		
			()	()	+	()		
			()	()	+-	()		
			()	()	-	(
\parallel			()	()	-	()		
			()	()		()		

LDC#: 48680I2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer: ______

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM) Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	3	4	RPD
QQQ	25.4	34.2	30
PPP	58.9	51.5	13
TT	2.4	2.6	8

	Concentra		
Compound	8	9	RPD
E	17.7	5.0U	NC
QQQ	9.3	7.3	24

	Concentra	tion (ug/Kg)		
Compound	11	12	RPD	
E	1.9	1.7	11	
QQQ	4.7	20.0U	NC	

V:\Josephine\FIELD DUPLICATES\48680I2b windward duwamish.wpd

LDC #: 48680I2b

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:_	_1_of_1_
Reviewer:	JХС
nd Reviewer: _	4

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	06/26/20	1,4-DCB (DCB)	1.37648	1.37648	1.36262	1.36262	2.6	2.6
	SIM		1,2,4-TCB (NPT)	0.39447	0.39447	0.41526	0.41526	7.6	7.6
	NT10		N-Nitrosodiphenylamine (PHN)	0.46933	0.46933	0.48124	0.48124	6.7	6.7

LDC # 48680I2a

VALIDATION FINDINGS WORSHEET Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

Where:

RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF

Cx = Concentration of compound,
Ais = Area of associated internal standard

RRF = continuing calibration RRF

Cis = Concentration of internal standard

Ax = Area of compound,

				-		Reported	Recalculated	Reported	Recalculated
		Calibration			Average RRF	RRF	RRF	% D	%D
#	Standard ID	Date	Compound	(IS)	(Initial)	(CCV)	(CCV)		
1	NT1020062902	6/29/2020	1,4-DCB	(DCB)	1.36262	1.33210	1.33210	2.2	2.2
			1,2,4-TCB	(NPT)	0.41526	0.40708	0.40708	2.0	2.0
	NT10		Pentachlorophenol	(PHN)	0.48124	0.49999	0.49999	3.9	3.9
						7			

LDC #:	486	80	I	26
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VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:_	_1_of_1_
Reviewer:_	JVG
2nd reviewer:	2

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 82702)-SIM

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14	5.00	3,445	68.9	68.9	0
Phenol-d5					
2-Fluorophenol	7.50	4.619	61.6	61.6	0
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference	
Nitrobenzene-d5						
2-Fluorobiphenyl						
Terphenyl-d14						
Phenol-d5						
2-Fluorophenol						
2,4,6-Tribromophenol						
2-Chlorophenol-d4						
1,2-Dichlorobenzene-d4						

LDC#: 48680 I26

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

	Page:_	<u>1_of_1_</u>
	Reviewer:_	JУG
2nd	Reviewer:	

E METHOD: GC/MS PAFI (EPA SW 846 Method 8270@-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: _

Compound		oike ded (Kg)	Sample Concentration	Concentration Concentration		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD		MS_	MSD	Reported	Recalc	_Reported	Recalc	Reported	Recalc
Acenaphthene											
Pyrene								·			
PGP	1500	(500	0	1310	1300	87.1	87.	86.8	86.7	0. \$63	0.77
						`				·	
					·						

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qu	ualifications and associated samples when reported results do not agree within
10.0% of the recalculated results.	

LDC#: 48680 I26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page:_	<u>1_0t_1_</u>
Reviewer:_	JXG
2nd Reviewer:	(1)

SV7A. E METHOD: GC/MS PAH (EPA SW 846 Method 8270@-SIM) SVA

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration

SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BJF 0662 - BS2

	Spike SpikeAdded ConcentrationCompound (以水。) (以水。)		Spike Concentration		LCS		LCSD		LCS/LCSD	
Compound			Percent I	Recovery	Percent F	Recovery	RPD			
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
Acenaphthene								,		
Pyrene										
Pap	1500	NA	1300	NA	86-8	86.8				
`		• •								
·										
									·	

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when report	<u>ed</u>
results do not agree within 10.0% of the recalculated results.	

LDC #:	48680 IZ6
LDC #:	40680 750

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	_1_of_1_
Reviewer:_	JVG
2nd reviewer:	6

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)

/Y	N	N/A
V	N	N/A

Were all reported results recalculated and verified for all level IV samples? Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $(A_x)(I_x)(V_t)(DF)(2.0)$ $(A_{is})(RRF)(V_o)(V_i)(%S)$

Area of the characteristic ion (EICP) for the compound to be measured

Area of the characteristic ion (EICP) for the specific internal standard

Amount of internal standard added in nanograms (ng)

Volume or weight of sample extract in milliliters (ml) or ٧٥

Volume of extract injected in microliters (ul) ٧,

Volume of the concentrated extract in microliters (ul) V,

Dilution Factor. Df

Percent solids, applicable to soil and solid matrices %S

Factor of 2 to account for GPC cleanup 20

xample:		
	_	

Conc. = \(\left(\frac{1037}{(157111)}\left(\frac{1.36262}{(17.359)}\left(\frac{0.5777}{0.5777}\right)}\)
= 1. 93 ug/kg

2.0	= Factor of 2 to accou	int for GPC cleanup			
#	Sample ID	Compound	Reported Concentration (W. /kt/a	Calculated Concentration (いったり)	Qualification
	7	1,4-DCB	1.9	, ,	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Laboratory Sample			Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS356MS	20F0194-01MS	Sediment	06/10/20
LDW20-SS356MSD	20F0194-01MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48680I3a SDG #: 20F0194

Stage 2B

Laboratory: Analytical Resources, Inc.

Reviewer: 2nd Reviewer

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments	
1.	Sample receipt/Technical holding times	SW/A	Cooler temps = 13.6° 15.6° 20,1° (Insuffice time to	cle
11.	GC Instrument Performance Check	11	(time t	o ka
111.	Initial calibration/ICV	AIA	1CAL = 203 WE 203	
IV.	Continuing calibration	A	10AL = 20 B CW = 30 Z	
V.	Laboratory Blanks	A		
VI.	Field blanks	N		
VII.	Surrogate spikes	A/A		
VIII.	Matrix spike/Matrix spike duplicates	Ä		
IX.	Laboratory control samples	Á	LCS	
X.	Field duplicates	100	D= 3/4 8/9 11/12	
XI.	Compound quantitation/RL/LOQ/LODs	N		
XII.	Target compound identification	N		╽
XIII.	System Performance	N		
XIV	Overall assessment of data			

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

***************************************	Client ID	Lab ID	Matrix	Date
1	LDW20-SS356	20F0194-01	Sediment	06/10/20
12	LDW20-SS364	20F0194-02	Sediment	06/10/20
13	LDW20-SS338 D ₁	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD $\mathcal{D}_{\mathbf{I}}$	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
+	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123 D2	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130 D3	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
13	LDW20-SS135	20F0194-13	Sediment	06/10/20
14	LDW20-SS356MS	20F0194-01MS	Sediment	06/10/20
15_	LDW20-SS356MSD	20F0194-01MSD	Sediment	06/10/20

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS364MS	20F0194-02MS	Sediment	06/10/20
LDW20-SS364MSD	20F0194-02MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0194	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SS338	LDW20-SS338-FD	RPD
Aroclor 1248	26.2	26.3	0
Aroclor 1254	33.8	33.8	0
Aroclor 1260	55.3	36.8	40

	Concentra		
Compound	LDW20-SS123	LDW20-SS123-FD	RPD
Aroclor 1248	25.0	27.2	8
Aroclor 1254	32.8	34.8	6
Aroclor 1260	36.7	130	112

	Concentra		
Compound	LDW20-SS130	LDW20-SS130-FD	RPD
Aroclor 1248	37.3	35.4	5
Aroclor 1254	53.3	46.1	14
Aroclor 1260	99.6	132	28

X. Compound Quantitation

All compound quantitations met validation criteria.

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS106	Aroclor-1248	42.5	J (all detects)	А

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and RPD between two columns, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	Α	Initial calibration verification (%D)
LDW20-SS106	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 4868013b

SDG #: 20F0194

Stage 4

Date: 08/64/2	2
Page: of	
Reviewer: 24	
2nd Reviewer:	

Laboratory: Analytical Resources, Inc.

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments (Lusufficient + insete)
I.	Sample receipt/Technical holding times	SW/A	corder temps = 13.6°C 15.6°C, 20.1°C (Text)
11.	Initial calibration/ICV	A / '	1 CV ≤ 20 Z
111.	Continuing calibration	A	COVE 20/3
IV.	Laboratory Blanks	L A	
V.	Field blanks	H	
VI.	Surrogate spikes (5	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	Á	LOS 19 SRM
IX.	Field duplicates	SW	D= 3/4 8/9 11/12
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	A	
XII	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

OTHER: EB = Equipment blank

SB=Source blank

	Client ID	Lab ID	Matrix	Date
7	LDW20-SS356	20F0194-01	Sediment	06/10/20
₂ t	LDW20-SS364	20F0194-02	Sediment	06/10/20
34	LDW20-SS338 7 ,	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD <i>b</i> ,	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
6	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123 D _Y	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD DV	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD $\rlap/$	20F0194-12	Sediment	06/10/20
13_	LDW20-SS135	20F0194-13	Sediment	06/10/20
14	LDW20-SS364MS	20F0194-02MS	Sediment	06/10/20
15	LDW20-SS364MSD	20F0194-02MSD	Sediment	06/10/20
16				
17	BIF0602-BULL			

LDC#: 48680 136

VALIDATION FINDINGS CHECKLIST

	Page:_	1	_of	1	
	Reviewer:		JV	3	
2nd	Reviewer:		7	_	
	_		V		

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times		·		
Were all technical holding times met?	/			,
Was cooler temperature criteria met?				
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?			/	
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?				
Were endrin and 4,4'-DDT breakdowns \leq 15% for individual breakdown in the Evaluation mix standards?				
Illa. Initial calibration			e Mille Market and American	
Did the laboratory perform a 5 point calibration prior to sample analysis?				
Were all percent relative standard deviations (%RSD) ≤ 20%?				
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of \geq 0.990?				
Were the RT windows properly established?				
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?				
Were all percent differences (%D) ≤ 20%?				
IV. Continuing calibration				
Was a continuing calibration analyzed daily?				
Were all percent differences (%D) ≤ 20%?				
Were all the retention times within the acceptance windows?				
V. Laboratory Blanks	/1			
Was a laboratory blank associated with every sample in this SDG?				
Was a laboratory blank analyzed for each matrix and concentration?				
Was there contamination in the laboratory blanks?				
VI. Field blanks				
Were field blanks identified in this SDG?				
Were target compounds detected in the field blanks?				,
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?				
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?				

LDC #: 46680 I 36

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: JV6
2nd Reviewer: ______

				
Validation Area	Yes	No	NA	Findings/Comments
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			/	
Were internal standard area counts within \pm 50% of the average area calculated during calibration?				
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?		Ĺ		
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?				
Were relative percent difference (RPD) of the results between two columns ≤ 40%?				
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?				
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans-Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	w
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	ww.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis-Heptachlor epoxide	XX.

Notes:	 	 	 		 		

LDC #: 48680 I36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:	1	_of	
Reviewer:		∜VG	ì
2nd Reviewer:			

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? /%D or %R

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

NN/A

Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications J/UJ/A (gual Z AA BB)
	06/10/20	SIF0176-SCV	1 20	ВВ	21.0	All (Pet)	J/uJ/A
	, ,						(and Z AA BB)
							(June 1 , rive page 1)
\vdash							
 							
 							
 							
<u> </u>							
							

LDC#: 4868013b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: JVG 2nd Reviewer:

METHOD: GC PCB (EPA SW 846 Method 8082A)

YN NA YN NA

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	3	4	RPD
Aroclor 1248	26.2	26.3	0
Aroclor 1254	33.8	33.8	0
Aroclor 1260	55.3	36.8	40

	Concentrat	220			
Compound	8	9	RPD		
Aroclor 1248	25.0	27.2	8		
Aroclor 1254	32.8	34.8	6		
Aroclor 1260	36.7	130	112		

	Concentrat		
Compound	11	12	RPD
Aroclor 1248	37.3	35.4	5
Aroclor 1254	53.3	46.1	14
Aroclor 1260	99.6	132	28

V:\Josephine\FIELD DUPLICATES\48680I3b windward duwamish.wpd

LDC #: 4868 I 35

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	of
Reviewer: _	JVG
2nd Reviewer:	1

METHOD: __GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

/<u>// N N/A</u> // N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the percent difference of detected compounds between two columns./detectors ≤40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	6	425	J dets/A
i 				

Comments: See sample calculation verification worksheet for recalculations

LDC #: 4868013b

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: <u>1</u>	_ of .	1_
Reviewer:	JV	3
2nd Reviewer:		

METHOD: GC PCBs (EPA SW 846 Method 8082A)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

		Calibration		Reported RRF	Recalculated RRF	Reported Average RRF	Recalculated Average RRF	Reported %RSD	Recalculated %RSD
#	Standard ID	Date	Compound (IS)	(250 std)	(250 std)	(Initial)	(Initial)		
1	ICAL	6/10/2020	1260-1 ZB5 (HBP)	0.03748	0.03748	0.03633	0.03633	1.944	1.946
	ECD7		1260-1 ZB35 (HBP)	0.04683	0.04683	0.04865	0.04865	13.540	13.537

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration Calculation Verification</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC PCBs (EPA SW 846 Method 8082A)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

Where:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF Ax = Area of compound,

Ais = Area of associated internal standard

Cx = Concentration of compound,

Cis = Concentration of internal standard

		Calibration		Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
#	Standard ID	Date	Compound (IS)	Conc	(CCV)	(CCV)	76 U	70.0
1	20062403ECD7	6/24/2020	1260-1 ZB5 (HBP)	250.0	270.6	270.6	8.2	8.2
<u> </u>			1260-1 ZB35 (HBP)	250.0	205.8	205.8	17.7	17.7
2	20062428ECD7	6/24/2020	1260-1 ZB5 (HBP)	250.0	286.1	286.1	10.6	14.5
L			1260-1 ZB35 (HBP)	250.0	202.5	202.5	3.6	19.0

LDC #: 48680 I 36

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:	_1_of_1_
Reviewer:	JVG
2nd reviewer:	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the	compounds identified below u	sing the following calculation
---	------------------------------	--------------------------------

% Recovery: SF/SS * 100

Where: SF = Surrogate Found SS = Surrogate Spiked

Sample ID: #

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	Coll	40.0	30.4	\$8. 2 76.	6 76.5	0
Tetrachloro-m-xylene				" '		
Decachlorobiphenyl	Coll	46.0	35.3	88. V	88.2	0
Decachlorobiphenyl	·					

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:_____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:	

LDC #: 486 80 [36

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1_of_1_ Reviewer: JVG 2nd Reviewer: ²

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the mat	rix spike and matrix spike duplicate were recalculated for the compounds identified below
using the following calculation:	

	%	Recovery	=	100*	(SSC-	SC	/SA
--	---	----------	---	------	-------	----	-----

Where: SSC = Spiked sample concentration

SA = Spike added

SC = Concentration

RPD = I MS - MSD I * 2/(MS + MSD)

MS = Matrix spike percent recovery

MSD = Matrix spike duplicate percent recovery

MS/MSD samples:_

	Spike Added		Sample		Spiked Sample		Matrix Spike		e Duplicate	MS/MSD	
Compound		uden らた)	Concentration (仏に)	Concentration (V5/5)		Percent Recovery		Percent	Recovery	RPD	
	MS	MSD		MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC											
4,4'-DDT											
Aroclor 1260	92.0	99.6	36.1	116	[20	86.8	86.8	84, ~	84,2	3.14	3.39
											,
											-

Comments: Refer of Matrix Spike/Matrix Spike Duplicates findings worksheet for list of quality of the comments	ualifications and asso	ciated samples when	reported results do no	ot agree within
10.0% of the recalculated results.				
				_

LDC #: 486 80 [36

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification</u>

	Page:_1	1_	_of_	1
	Reviewer:_	,	WC	<u>; </u>
2nd	Reviewer:	٦	U	

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration SA = Spike added

SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: BIF U602- BS/

	S	pike		d Sample	L	.cs	LC	CSD	LC	S/LCSD	
Compound	ζû	dded g/Kg)		entration	Percent	t Recovery	Percent	Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.	
gamma-BHC											
4,4'-DDT											
Aroclor 1260	101	61	98.5	9&1	97.7	97.5	97.3	97, 1	0.427	0467	
			:								

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported
results do not agree within 10.0% of the recalculated results.

LDC #:___48680136

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1_of_1_
Reviewer:	JVG /
2nd reviewer:	N

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Y	N	N/A
\bigcirc	N	N/A

Were all reported results recalculated and verified for all level IV samples?
Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration	=_	(A) (Fv) (Df)
	_	(RF) (Vs or Ws) (%S/100)

A = Area of compound

Fv = Final Volume of extract

Df = Dilution Factor

RF = Average Response Factor of compound in ICal

Vs = Initial Volume of sample Ws = Initial Weight of sample

%S = Percent Solid

Sample I.D. |2 |260 (Col 1)

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#	Sample ID	Compound	Reported Concentration (VG)	Calculated Concentration (以 ル	Qualification
	12	1260	132	132	-
				<u> </u>	
\vdash					
					
				ļ	

Note:		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS125MS	20F0194-10MS	Sediment	06/10/20
LDW20-SS125MSD	20F0194-10MSD	Sediment	06/10/20
LDW20-SS125DUP	20F0194-10DUP	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Silver	0.02 mg/Kg	LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135
ICB/CCB	Silver	0.02 ug/L	All samples in SDG 20F0194

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS125	Silver	0.27 mg/Kg	0.27U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS130	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-SS130-FD	Silver	0.13 mg/Kg	0.13U mg/Kg
LDW20-SS135	Silver	0.09 mg/Kg	0.09U mg/Kg
LDW20-SS356	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SS364	Silver	0.2 mg/Kg	0.2U mg/Kg
LDW20-SS338	Silver	0.24 mg/Kg	0.24U mg/Kg
LDW20-SS338-FD	Silver	0.27 mg/Kg	0.27U mg/Kg
LDW20-SS336	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS106	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS121	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS123	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SS123-FD	Silver	0.14 mg/Kg	0.14U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS366 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123 LDW20-SS123-FD)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	A

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT334MS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS36 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123 LDW20-SS123-FD)	Mercury	-	127 (75-125)	J (all detects)	A
LDW20-SS125MS/MSD (LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135)	Mercury	138 (75-125)	143 (75-125)	J (all detects)	А
LDW20-SS125MS/MSD (LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135)	Silver	62.5 (75-125)	60.7 (75-125)	J (all detects)	А

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123 LDW20-SS123-FD)	Silver	23 (≤20)	J (all detects)	A

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra	Concentration (mg/Kg)		
Analyte	LDW20-SS338	LDW20-SS338-FD	RPD	
Arsenic	17.0	16.5	3	
Cadmium	0.26	0.30	14	
Chromium	27.1	27.6	2	
Copper	54.8	55.2	1	
Lead	17.9	18.6	4	
Mercury	0.143	0.161	12	
Silver	0.24	0.27	12	
Zinc	111	112	1	

	Concentra		
Analyte	LDW20-SS123	LDW20-SS123-FD	RPD
Arsenic	7.34	6.66	10
Cadmium	0.26	0.20	26
Chromium	20.1	19.0	6
Copper	34.4	30.4	12
Lead	14.3	12.2	16
Mercury	0.116	0.0777	40
Silver	0.17	0.14	19
Zinc	76.8	72.3	6

	Concentra	Concentration (mg/Kg)		
Analyte	LDW20-SS130	LDW20-SS130-FD	RPD	
Arsenic	6.16	5.68	8	
Cadmium	0.18	0.20	11	
Chromium	20.2	22.6	11	
Copper	28.2	34.3	20	
Lead	11.8	11.8	0	
Mercury	0.0919	0.0684	29	
Silver	0.14	0.13	7	
Zinc	66.7	67.7	1	

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD, data were qualified as estimated in thirteen samples.

Due to laboratory blank contamination, data were qualified as not detected in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0194

Sample	Analyte	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125-FD LDW20-SS130 LDW20-SS130-FD LDW20-SS130-FD LDW20-SS135	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS366 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123	Silver	J (all detects)	Α	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0194

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS125	Silver	0.27U mg/Kg	А
LDW20-SS130	Silver	0.14U mg/Kg	А
LDW20-SS130-FD	Silver	0.13U mg/Kg	А
LDW20-SS135	Silver	0.09U mg/Kg	А
LDW20-SS356	Silver	0.17U mg/Kg	А
LDW20-SS364	Silver	0.2U mg/Kg	Α
LDW20-SS338	Silver	0.24U mg/Kg	А
LDW20-SS338-FD	Silver	0.27U mg/Kg	А
LDW20-SS336	Silver	0.16U mg/Kg	А

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS106	Silver	0.18U mg/Kg	Α
LDW20-SS121	Silver	0.18U mg/Kg	A
LDW20-SS123	Silver	0.17U mg/Kg	А
LDW20-SS123-FD	Silver	0.14U mg/Kg	Α

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Laboratory: Analytical Resources, Inc.

LDC #: 48680I4a

SDG #: 20F0194

Date: 7/30/20 Page: 1 of 2

Reviewer: ATL 2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	A/A	
11.	ICP/MS Tune	Α	
III.	Instrument Calibration	Α	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	sw	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	sw	(14,15), From SDG # 20F0191 (LDW20-IT334MS/MSD), SDG # 20F0186 (LDW20-IT379FD MS/MSD)
VIII.	Duplicate sample analysis	Α	16, From SDG # 20F0191 (LDW20-IT334DUP), SDG # 20F0186 (LDW20-IT379FD DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	Α	LCS/SRM
XI.	Field Duplicates	sw	(3,4), (8,9), (11,12)
XII.	Internal Standard (ICP-MS)	N	
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	Α	

A = AcceptableNote:

12

13

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

20F0194-12

20F0194-13

20F0194-10MS

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

Sediment

Sediment

Sediment

06/10/20

06/10/20

06/10/20

Client ID Lab ID Matrix Date LDW20-SS356 20F0194-01 Sediment 06/10/20 LDW20-SS364 20F0194-02 Sediment 06/10/20 3 LDW20-SS338 20F0194-03 Sediment 06/10/20 LDW20-SS338-FD 20F0194-04 Sediment 06/10/20 LDW20-SS336 5 20F0194-05 Sediment 06/10/20 6 LDW20-SS106 20F0194-06 Sediment 06/10/20 LDW20-SS121 20F0194-07 Sediment 06/10/20 8 LDW20-SS123 20F0194-08 Sediment 06/10/20 9 LDW20-SS123-FD 20F0194-09 Sediment 06/10/20 LDW20-SS125 10 20F0194-10 Sediment 06/10/20 11 LDW20-SS130 20F0194-11 Sediment 06/10/20

LDW20-SS130-FD

LDW20-SS125MS

LDW20-SS135

SDG Labo	#: 48680I4a VALIDAT G #: 20F0194 pratory: Analytical Resources, Inc. THOD: Metals (EPA SW 846 Method 66)	Date: <u>7/30/20</u> Page: ★♪ of 2 Reviewer: ATL 2nd Reviewer:		
	Client ID	Lab ID	Matrix	Date
15	LDW20-SS125MSD	20F0194-10MSD	Sediment	06/10/20
16	LDW20-SS125DUP	20F0194-10DUP	Sediment	06/10/20
17				
18				
19				
Note	s:			

LDC #: 48680I4a

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
QC	
14,15,16	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
	Analysis Method
ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: 10 to 13

							Samp	ole Identificati	on		
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	10	11	12	13				
Ag	0.02			0.27	0.14	0.13	0.09				

Sample Concentration, unless otherwise noted: mg/kg

Associated Samples: all

Jumpie Jo		i, unicas otne				ASSOCIATED						
				Sample Identification								
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	1	2	3	4	5	6	7	8	9
Ag		0.02		0.17	0.2	0.24	0.27	0.16	0.18	0.18	0.17	0.14
					L	<u> </u>	I Samp	l ole Identific	ation	I		
Analyte	PB (mg/kg)	Maximum ICB/CCB (ug/L)	Action Level	10	11	12	13					
Ag		0.02		see above	see above	see above	see above					

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Page 1 of 1 Reviewer: ATL

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

MS/MSD analysis was performed by the laboratory. All MS/MSD percent recoveries (%R) and relative percent differences (RPDs) were within the acceptable limits with the following exceptions:

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
LDW20-IT379FD	S	Ag	34.1	43.2	75-125			1 to 9	J/UJ/A	Det
		Ag				23	20	1 to 9	J/UJ/A	Det
LDW20-IT334	S	Hg		127	75-125			1 to 9	Jdet/A	Det
14 & 15		Hg	138	143	75-125			10 to 13	Jdet/A	Det
		Ag	62.5	60.7	75-125			10 to 13	J/UJ/A	Det
									 	
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Comments:

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer: ATL

Method: Metals

	Concentrat	ion (mg/kg)	RPD	O - lifi (Bt- Only)
Analyte	3	4		Qualifiers (Parents Only)
Arsenic	17.0	16.5	3	
Cadmium	0.26	0.30	14	
Chromium	27.1	27.6	2	
Copper	54.8	55.2	1	
Lead	17.9	18.6	4	
Mercury	0.143	0.161	12	
Silver	0.24	0.27	12	
Zinc	111	112	1	

A1-4-	Concentra	tion (mg/kg)	RPD	Overlifficate (Paranta Only)
Analyte	8	9	1	Qualifiers (Parents Only)
Arsenic	7.34	6.66	10	
Cadmium	0.26	0.20	26	
Chromium	20.1	19.0	6	
Copper	34.4	30.4	12	
Lead	14.3	12.2	16	
Mercury	0.116	0.0777	40	
Silver	0.17	0.14	19	
Zinc	76.8	72.3	6	

Amalida	Concentrat	tion (mg/kg)	RPD	Qualifiero (Baranto Only)	
Analyte	11	12	1	Qualifiers (Parents Only)	
Arsenic	6.16	5.68	8		
Cadmium	0.18	0.20	11		
Chromium	20.2	22.6	11		
Copper	28.2	34.3	20		
Lead	11.8	11.8	0		
Mercury	0.0919	0.0684	29		
Silver	0.14	0.13	7		
Zinc	66.7	67.7	1		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 10, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS356DUP	20F0194-01DUP	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concen		
Analyte	LDW20-SS338	LDW20-SS338-FD	RPD
Total solids	39.01	38.79	1
Total organic carbon	3.12	3.30	6

	Concent		
Analyte	LDW20-SS123	LDW20-SS123-FD	RPD
Total solids	62.87	61.53	2
Total organic carbon	1.03	1.14	10

	Concen		
Analyte	LDW20-SS130	LDW20-SS130-FD	RPD
Total solids	66.58	66.31	0
Total organic carbon	0.89	0.87	2

X. Sample Result Verification

All sample result verifications were acceptable.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 4868016 VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0194 Stage 4

Laboratory: Analytical Resources, Inc.

ENESS WORKSHEET

Date: 7/30/20

Page: 1 of 1

Reviewer: ATL

2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A/A	
- 11	Initial calibration	А	
III.	Calibration verification	А	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	From SDG # 20F0191 (LDW20-IT228MS)
VII.	Duplicate sample analysis	А	14, From SDG # 20F0191 (LDW20-IT228DUP)
VIII.	Laboratory control samples	Α_	LCS/SRM
IX.	Field duplicates	sw	(3,4), (8,9), (11,12)
X.	Sample result verification	А	
XI.	Overall assessment of data	A	

Note: A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS356	20F0194-01	Sediment	06/10/20
2	LDW20-SS364	20F0194-02	Sediment	06/10/20
3	LDW20-SS338	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
6	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
13	LDW20-SS135	20F0194-13	Sediment	06/10/20
14	LDW20-SS356DUP	20F0194-01DUP	Sediment	06/10/20
15				

Notes:	 	 	
		 	_

Reviewer: ATL

Was a method blank associated with every sample in this SDG? Was there contamination in the method blanks? Was there contamination in the initial and continuing calibration blanks? W. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates Were MS/MSD recoveries within the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.) Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits? V. Laboratory Control Samples Was a LCS analyzed for each batch in the SDG? X Were the LCS recoveries and RPDs (if applicable) within QC limits? X. Sample Result Verification Were all reporting limits adjusted to reflect sample dilutions? X Were all soil samples dry weight corrected? X XI. Overall Assessment of Data Was the overall assessment of the data	METHOD: Inorganics					
Were all technical holding times met? X II. Calibration Were all instruments calibrated at the required frequency? Were the proper number of standards used? X Were all initial and continuing calibration verifications within the QC limits? Were all initial calibration correlation coefficients within limits as specified by the method? X Were balance checks performed as required? XIII. Blanks Was a method blank associated with every sample in this SDG? Was there contamination in the method blanks? Was there contamination in the initial and continuing calibration blanks? IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates Were MS/MSD recoveries within the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.) Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits? VI. Laboratory Control Samples Was a LCS analyzed for each batch in the SDG? X Were the LCS recoveries and RPDs (if applicable) within QC limits? X Sample Result Verification Were all reporting limits adjusted to reflect sample dilutions? X Were all soil samples dry weight corrected? X XI. Overall Assessment of the data Was the overall assessment of the data		Yes	No	NA	Comments	
II. Calibration Were all instruments calibrated at the required frequency? Were the proper number of standards used? Were all initial and continuing calibration verifications within the QC limits? Were all initial calibration correlation coefficients within limits as specifed by the method? Were blance checks performed as required? III. Blanks Was a method blank associated with every sample in this SDG? Was there contamination in the method blanks? Was there contamination in the initial and continuing calibration blanks? IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates Were MS/MSD recoveries within the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.) Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits? V. Laboratory Control Samples Was a LCS analyzed for each batch in the SDG? X Were the LCS recoveries and RPDs (if applicable) within QC limits? X Sample Result Verification Were all reporting limits adjusted to reflect sample dilutions? X Were all soil samples dry weight corrected? X X Overall Assessment of Data Was the overall assessment of the data	I. Technical holding times					
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found to be acceptable?	Was the overall assessment of the data					
	found to be acceptable?	х				

METHOD: Inorganics				
Validation Area	Yes	No	NA	Comments
XII. Field Duplicates				
		i		
Were field duplicates identifed in this SDG?	Х			L
Were target analytes detected in the field				
duplicates?	х			
XIII. Field Blanks				
Were field blanks identified in this SDG?		Х		
Were target analytes detected in the field				
blanks?			x	

LDC #: 4868016

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer: ATL

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	TS, TOC
QC	
14	TS
i	

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

	Concent	ration (%)	RPD	(5
Analyte =	3	4		Qualifiers (Parents Only)
Total Solids	39.01	38.79	1	
Total Organic Carbons	3.12	3.30	6	

Analista	Concentration (%)		RPD	Ovelitiere (Perente Only)
Analyte	8 9		Qualifiers (Parents Only)	
Total Solids	62.87	61.53	2	
Total Organic Carbons	1.03	1.14	10	

Analista	Concent	ration (%)	RPD	Ovelifiere (Berente Only	
Analyte =	11	12		Qualifiers (Parents Only)	
Total Solids	66.58	66.31	0		
Total Organic Carbons	0.89	0.87	2		

VALIDATION FINDINGS WORKSHEET <u>Initial and Continuing Calibration Calculation Verification</u>

Page:	of
Reviewer:	ATTU
nd Reviewer:	2

METHOD: Inorganics, Method	NC (EPA 9060A)				
The correlation coefficient (r) for the	he calibration ofWas recalculated. Calibration date:				
An initial or continuing calibration	verification percent recovery (%R) was recalculated for each type of analysis using the following formula:				
%R = <u>Found</u> x 100 Where, True Found = concentration of each analyte <u>measured</u> in the analysis of the ICV or CCV solution True = concentration of each analyte in the ICV or CCV source					

Time of Aughoria	Amaluta	Cton double	90	90	Recalculated	Reported	Acceptable
Type of Analysis	Analyte	Standard ID	Found (units)	True (units)	r or %R	r or %R	(Y/N)
Initial calibration		Blank					
		Standard 1					
		Standard 2				NIA	
	NA	Standard 3			NA		N/A ·
	1011.	Standard 4			I NAI		<i>μ</i> γτι
		Standard 5					
		Standard 6					
		Standard 7					·
Calibration verification	TOC		44.782	44.446	101	101	У
CCVB	TDC		44.927	44.446	101	101	Y
Calibration verification	TOC		45.155	44.446	102	102	Y

Comments:	Refer to Calibration '	Verification findings w	vorksheet for list of qua	alifications and asso	ciated samples whe	en reported results do	not agree within 1	0.0% of the
ecalculated	results.					•		:
		<u> </u>						
								•

VALIDATION FINDINGS CHECKLIST Quality Control Sample Recalculations

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

					Recalculated	Reported	
Sample ID	Type of Analysis	Element	Found/S	True/D	%R/RPD	%R/RPD	Acceptable (Y/N)
LCS	LCS	TOC	44.48	44.4	100.1801802	100	Υ
LDW20-IT228MS	MS	TOC	1.162	1.32	88.03030303	87.9	Υ
14	Duplicate	TS	44.6896	44.571	0.265738747	0.266	Υ

VALIDATION FINDINGS CHECKLIST <u>Sample Calculation Verification</u>

Page 1 of 1 Reviewer: ATL

METHOD: Inorganics

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids (if applicable) x Initial weight or volume)

Sample ID	Analyte	Raw Data (%)		Initial Weight/ Volume (g)		Percent solids (%)	Reported Result (%)	Recalculated Result (%)	Acceptable (Y/N)
	TS	naw Buta (70)	1	5.2855	.0,	<u> </u>	44.57	44.57099612	
	TOC	1.292	1	0.1926					
	TS		1	5.3274	2.0781		39.01	39.00777115	Υ
4	тос	1.28	1	0.2071	0.2071	38.79	3.3	3.299819541	Υ
5	TS		1	5.3714	2.3906		44.51	44.5060878	Υ
6	TOC	0.922	1	0.3038	0.3038	44.46	2.07	2.073774179	Υ
7	TS		1	6.1452	3.4749		56.55	56.54657293	Υ
8	TOC	0.646	1	0.2484	0.2484	62.87	1.03	1.027517099	Υ
9	TS		1	6.3469	3.9052		61.53	61.5292505	Υ
10	TOC	1.258	1	0.3344	0.3344	48.8	2.58	2.577868852	Υ
11	TS		1	6.2133	4.1368		66.58	66.57975633	Υ
12	TOC	0.577	1	0.191	0.191	66.31	0.87	0.870155331	Υ
13	TS		1	6.2156	4.5569		73.31	73.31391981	Υ

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0194

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SS130	LDW20-SS130-FD	RPD
2,3,7,8-TCDF	0.397	0.418	5
2,3,7,8-TCDD	0343	0.254	30
1,2,3,7,8-PeCDF	0.278	0.995U	Not calculable

	Concentra			
Compound	LDW20-SS130	LDW20-SS130-FD	RPD	
2,3,4,7,8-PeCDF	0.483	0.541	11	
1,2,3,7,8-PeCDD	0.508	0.639	23	
1,2,3,4,7,8-HxCDF	1.94	1.77	9	
1,2,3,6,7,8-HxCDF	0.657	0.750	13	
2,3,4,6,7,8-HxCDF	0.851	0.867	2	
1,2,3,7,8,9-HxCDF	0.393	0.385	2	
1,2,3,4,7,8-HxCDD	0.419	0.602	36	
1,2,3,6,7,8-HxCDD	2.12	2.15	1	
1,2,3,7,8,9-HxCDD	1.20	1.42	17	
1,2,3,4,6,7,8-HpCDF	14.2	12.6	12	
1,2,3,4,7,8,9-HpCDF	1.28	1.17	9	
1,2,3,4,6,7,8-HpCDD	67.2	61.1	10	
OCDF	41.4	34.5	18	
OCDD	542	522	4	
Total TCDF	3.42	5.08	39	
Total TCDD	0.271	1.05	118	
Total PeCDF	5.42	5.39	1	
Total PeCDD	0.526	1.25	82	
Total HxCDF	19.4	18.7	4	
Total HxCDD	14.0	13.3	5	
Total HpCDF	55.1	42.6	26	
Total HpCDD	157	141	11	

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0194	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS336 LDW20-SS130 LDW20-SS130-FD	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

SDG #	#:		PLETENESS Stage 4	WORKSHEET	D	Date: 08/07/20 Page: 1 of 1
Labora	atory: <u>Analytical Resources, Inc.</u>					eviewer: JVG eviewer: JVG
METH	OD: HRGC/HRMS Polychlorinated Diox	ins/Dibenz	zofurans (EPA	Method 1613B)		V
	amples listed below were reviewed for eation findings worksheets.	ch of the	following valida	tion areas. Validatio	n findings are n	oted in attached
	Validation Area			Comm	ents	
1.	Sample receipt/Technical holding times	SW/A	Cooler temp = 1	3.6, 15.6, 20.1 deg C	(Insuffic	ient time to cool)
II.	HRGC/HRMS Instrument performance check	Α				
III.	Initial calibration/ICV	A/A	ICAL ≤ 2	20/35%	ICV ≤ Q0	C Limits
IV.	Continuing calibration	A	CCV ≤ (QC Limits		
V.	Laboratory Blanks	sw				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N				
VIII.	Laboratory control samples	Α	OPR,	SRM		
IX.	Field duplicates	sw	D = 3/-			
X.	Labeled Compounds	A				
XI.	Compound quantitation RL/LOQ/LODs	Α	EMPC	= Jdets/A		
XII.	Target compound identification	А				
XIII.	System performance	А				
XIV.	Overall assessment of data	А				
Note:	N = Not provided/applicable R = Rir	lo compound sate ield blank	ds detected	D = Duplicate TB = Trip blank EB = Equipment blanl	SB=Source OTHER:	e blank
	Client ID			Lab ID	Matrix	Date
1 1	_DW20-SS356			20F0194-01	Sediment	06/10/20
2	LDW20-SS336			20F0194-05	Sediment	06/10/20
3	LDW20-SS130			20F0194-11	Sediment	06/10/20
4	_DW20-SS130-FD			20F0194-12	Sediment	06/10/20
5		<u> </u>				
6						
7						
8						
9						
10						
Notes:						

BIF0780-BLK1

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: WG
2nd Reviewer:

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times			_	
All technical holding times were met.	√			
Cooler temperature criteria was met.		√		
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	√_			
Were the retention time windows established for all homologues?	√_			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 25% ?	√			
Is the static resolving power at least 10,000 (10% valley definition)?	√			
Was the mass resolution adequately check with PFK?	√			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	√			
Illa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	√			
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled compounds and \leq 35% for unlabeled compounds?	√			
Did all calibration standards meet the Ion Abundance Ratio criteria?	√_			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	√			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	√			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	√			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	√			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	√			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	√			
V. Blanks			_	
Was a method blank associated with every sample in this SDG?	√			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	√			
Was there contamination in the method blanks?	√			
VI. Field blanks				
Were field blanks identified in this SDG?		√		
Were target compounds detected in the field blanks?			√	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		√		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

VALIDATION FINDINGS CHECKLIST

Page: 1_of_2 Reviewer: JVG 2nd Reviewer: _____

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	√			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	√			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	√			
Were target compounds detected in the field duplicates?	√			
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	√			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	√			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	√			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	~			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	√			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	√			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	√			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	√		-	
Did compound spectra contain all characteristic ions listed in the table attached?	√			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	√			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	√			
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?	√			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?	√			
Was an acceptable lock mass recorded and monitored?	√			
XIII. System performance				
System performance was found to be acceptable.	√			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	√_			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:		

VALIDATION FINDINGS WORKSHEET Blanks

Page _	<u>1_of_1_</u>
Reviewer:_	J <u>V</u> G
2nd Reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

- $\frac{Y}{Y}$ Were all samples associated with a method blank?
- Was a method blank performed for each matrix and whenever a sample extraction was performed?
- Was the method blank contaminated?

Blank extraction date: 06/29/20 Blank analysis date: 07/02/20 Associated samples: All (>5X) Conc. units: ng/Kg

Compound	Blank ID		Sample Identification						
	BIF0780-BLK1	(5x)							
0	0.0726*	0.36							
F	0.220*	1.10							
Q	0.477*	2.39							
G	1.66	8.30							

*EMPC

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B) Y N NA Were field duplicate pairs identified in this SDG?

YNNA Were target analytes detected in the field duplicate pairs?

	Concentra			
Compound	3	4	RPD	
Н	0.397	0.418	5	
Α	0.343	0.254	30	
1	0.278	0.995U	NC	
J	0.483	0.541	11	
В	0.508	0.639	23	
К	1.94	1.77	9	
L	0.657	0.750	13	
М	0.851	0.867	2	
N	0.393	0.385	2	
С	0.419	0.602	36	
D	2.12	2.15	1	
E	1.20	1.42	17	
0	14.2	12.6	12	
Р	1.28	1.17	9	
F	67.2	61.1	10	
Q	41.4	34.5	18	
G	542	522	4	
V	3.42	5.08	39	
R	0.271	1.05	118	
W	5.42	5.39	1	
S	0.526	1.25	82	
х	19.4	18.7	4	
Т	14.0	13.3	5	
Υ	55.1	42.6	26	
U	157	141	11	

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:	_1_ of _	_1_
Reviewer:	JVG	
nd Reviewer:		

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

					Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
		Calibration			RRF	RRF	Average RRF	Average RRF	%RSD	%RSD
#	Standard ID	Date	Com	pound (IS)			(Initial)	(Initial)		
1	ICAL	7/1/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
	Autospec01		2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
			1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
			OCDD	(13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: _1_ of _1_
Reviewer: _____JVG
2nd Reviewer: ______

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_x = Area of Compound

A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards

 C_x = Concentration of compound,

C_{is} = Concentration of internal standard

%RSD = 100 * (S/X)

S= Standard deviation of the RRFs,

X = Mean of the RRFs

		Calibration			Reported RRF	Recalculated RRF	Reported Average RRF	Recalculated Average RRF	Reported %RSD	Recalculated %RSD
#	Standard ID	Date	Com	pound (IS)			(Initial)	(Initial)		
1	ICAL	7/1/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
	Autospec01		2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
	ļ		1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
		L	OCDD	(13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration Calculation Verification</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

Where:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF

ave. RRF = initial calibration average RRF

Cx = Concentration of compound,

RRF = (Ax)(Cis)/(Ais)(Cx)

RRF = continuing calibration RRF

Ais = Area of associated internal standard

Ax = Area of compound, Cis = Concentration of internal standard

			*			Reported	Recalculated	Reported	Recalculated
		Calibration			Average RRF	RRF	RRF	% D	%D
#	Standard ID	Date	Compou	ınd (Ref IS)	(Initial)	(CCV)	(CCV)		
1	20070202	7/2/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8223	0.8060	0.8060	2.0	2.0
	Autospec01		2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2310	1.2380	1.2380	0.6	0.6
i			1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9154	0.9359	0.9359	2.2	2.2
ĺl i			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1246	1.1394	1.1394	1.3	1.3
			OCDD	(13C-OCDD)	1.2095	1.1641	1.1641	3.8	3.8

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

	Page:	1	of	1
	Reviewer:		IV(3
2nd	Reviewer:	7	1)	
		_		_

METHOD: GC/MS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration

SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

	Sı	oike	Spiked Sample		LCS		LCSD		LCS/LCSD	
Compound	Added (ng/Kg)		Concentration (ng/Kg)		Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
2,3,7,8-TCDD	20		19.97		99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	_1_of_1_
Reviewer:	JVG
2nd reviewer:	8

METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B)

- Y
 Y
 Were all reported results recalculated and verified for all level IV samples?
 Y
 Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concer	ntration	$n = \frac{(A_s)(I_s)(DF)}{(A_s)(RRF)(V_o)(\%S)}$	Example:
$\mathbf{A}_{\mathbf{x}}$	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D1,OCDD
A_is	=	Area of the characteristic ion (EICP) for the specific internal standard	
l _s	=	Amount of internal standard added in nanograms (ng)	Conc. = (9.932e5+1.120e6)(200)(20uL) (4.626e5+4.974e5)(1.2095)(22.38g)(0.4483)
V_{o}	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	
RRF	=	Relative Response Factor (average) from the initial calibration	= 725.6
Df	=	Dilution Factor.	= 726 ng/Kg
%S	=	Percent solids, applicable to soil and solid matrices only.	

#	Sample ID	Compound	Reported Concentration (ng/Kg)	Calculated Concentration (ng/Kg)	Acceptable (Y/N)
	1	OCDD	726	726	_